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Analysis of single and multi-grade lubricant film thickness in a diesel engine.

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by

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B.S. Ocean Engineering, U.S. Naval Academy
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ABSTRACT

ANALYSIS OF SINGLE AND MULTI-GRADE LUBRICANT FILM THICKNESS IN A DIESEL ENGINE

by
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Submitted to the Department of Ocean Engineering in partial fulfillment of the requirements for the degrees of Master of Science in Naval Architecture/Marine Engineering and Master of Science in Mechanical Engineering.

ABSTRACT

Several recent experiments have been made to attempt to determine the rheology of the lubricant in journal bearings of engines. A laser fluorescence technique in use at the Massachusetts Institute of Technology allows accurate data collection of the oil film thickness on the ring pack of a production diesel engine. The data collected from the Kubota EA300N IDI engine consisted of five different types of lubricant--two single-grades, two multi-grades, and a synthetic multi-grade.

The data was analyzed and it was found that the lubricant under the compression ring acts in a Newtonian manner independent of lubricant type or inertial effects. The difference between the types of lubricants appears to be the degree to which oil wets the ring--with the single-grade oils wetting the ring more thoroughly than do the multi-grades. A consistent linear relationship between the inlet wetting of the ring and the bearing number (a non-dimensional lift term) was found to exist for each stroke. Drag was also found to be inversely proportional to the amount of inlet wetting.

Thesis Supervisor: Dr. David P. Hoult
Title: Senior Research Associate
Department of Mechanical Engineering

ACKNOWLEDGEMENTS

I would be unable to submit this thesis without giving credit to those people who encouraged me and provided insight when it was most needed.

. First to thank is Dr. David P. Hoult, my thesis supervisor. He proved to be a very patient man as he watched me struggle through some tough times in the data analysis. He was always available to answer my questions and not let me stray too far out of line. Without his help I would still be bogged down in the tens of data sets that were collected.

The entire staff at the Sloan Automotive Laboratory proved helpful many times. Employed there are many staff members and students to numerous to name. Several persons require special mention. Lt. Matt Bliven, USCG was my office mate for a year and a half. He provided much confidence and common sense advice when things got tough. Jeff Lux and Mark McElwee were the greatest help when I first arrived at the lab. The time they took out of their research to guide me along is much appreciated. Mr. Don Fitzgerald and Brian Corkum were always in the lab ready to lend assistance when required. Finally, Richard Hartman provided help in obtaining last minute data and engine operating conditions.

I am also grateful to Mr. Tayeb Benchaita of the Pennzoil Products Company. His timely analysis of oil samples and constant technical advice is appreciated.

Lastly, I would like to thank my wife, Laraine. She was extremely understanding and provided me with strength and encouragement when it was needed most.

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CHAPTER 1 - INTRODUCTION

1.1 Background

Recently, several experiments have been run in an effort to determine the relationship between lubricant rheology under journal bearings and the performance of these bearings (Spearot et al, Deysarkar, Bates et al). The major conclusion drawn from these works is that there is more to the problem of rheology than the High Temperature / High Shear (HTHS) viscosity relationship. Spearot equates single-grade oils with Newtonian characteristics, whereas the multi-grades he considers to be non-Newtonian. Deysarkar suggests that additional engine and oil parameters need to be introduced in order to fully understand the relationship between oil film thickness and lubricant rheology. It is this relationship to which this data analysis has been directed.

This research presents a lubrication theory which, given that the assumptions and approximations are correct, allows for several conclusions to be drawn about the lubricant rheology and its relationship to film thickness and piston ring friction.

1.2 Data Collection

A laser fluoresence technique for determining diesel engine oil film thicknesses has been in use for several years at the Massachusetts Institute of Technology. Billian, Lux and McElwee all showed that the technique can be used to measure film thicknesses on the piston and in the ring pack. McElwee collected data with the technique on five different types of oil -- two single-grades, two multi-grades and a synthetic multi-grade. The data was collected from the Kubota EA300N, a small, single cylinder 0.3 liter indirect-injection diesel engine. For each lubricant tested, 20 different operating conditions were recorded. This collection of data showed that the oil film thickness measurements were accurate and repeatable. McElwee's data is further analyzed within this paper.

1.3 Analysis Methodology

McElwee attempted to show that the lubricants used behaved in a Newtonian manner under the piston rings of the Kubota engine. The results of McElwee's work were inconclusive for two major reasons:

1. The lubrication model used was deficient in the specification of boundary conditions.
2. There was a great deal of variability in the film traces from *cycle to cycle*.

The major objective of this research is, therefore, to investigate this variability on a cycle to cycle basis. By examining individual cycle film traces, it is believed that the lubrication model can be modified sufficiently to provide evidence of correlation for all five types of oil -- single and multi-grades.

Analysis of the film trace was carried out in the same manner as in McElwee's work, however, the method was applied to many individual cycles instead of the composite average of one type of stroke in a particular data set. A digitized and scaled ring profile was used to determine the location of the piston ring on the film trace. Once the ring was satisfactorily placed, several points of data were taken from the trace. Figure 1 shows the placement of the ring profile on an actual film trace. Figure 2 is a idealized sketch of the specific points of data required from each film trace in order to begin the analysis. Placement of the ring and collection of data points was repeated for each revolution, stroke, engine speed, and lubricant type. Appendices B and C provide, in a spreadsheet format, the actual data collected and subsequent data reduction (which will be discussed later) for the exhaust and compression strokes of each oil, respectively.

1.4 Choice of Data

Initially, only motored exhaust strokes for oil films under the compression ring were analyzed. Restricting the survey to only the exhaust strokes has several advantages. First, the film traces were clear and distinct. Placement of the compression ring was considerably easier than that of a downstroke.

Second, analysis required an estimate of the pressure difference across the ring. A computer code was developed by Hoult which predicts blowby across the rings, as well as the pressure on each of the piston lands. This code was developed from the work of Namazian and Heywood. In order to reduce the effects of inaccuracies in this code and to reduce the actual pressure loading term on the ring itself, it was decided to use only the exhaust stroke for initial analysis.

Third, by motoring the engine and allowing all temperatures to stabilize, a more accurate estimate of oil temperature under the compression ring could be made. An identical Kubota engine was equipped with temperature sensors in three positions along the cylinder liner. This engine was run at the same operating conditions as the test engine and the cylinder liner temperatures were recorded. Since the engine was being motored and all engine conditions were stable, the oil temperature was estimated to be the same as the cylinder liner temperature. Information concerning the HTHS viscosity of each lubricant was provided by Benchaita. This data was interpolated to determine the actual viscosity at the estimated temperatures of the oils.

Finally, an analysis methodology and supporting theory was developed using the exhaust stroke data. This allowed for analysis of the remaining strokes to progress at a much quicker pace.

1.5 Assumptions/Approximations

The data analysis which is presented begins with the Reynolds equation for lubrication theory as described by Cameron. Prior to theory development, several

assumptions and approximations are made in order to simplify the problem. Assumptions are those conditions which are commonly accepted as valid when solving the Reynolds equation and used throughout this paper.

1. There are no external forces acting on the lubricant. No electrical or magnetic forces are considered to be influencing the performance of the oil.
2. The pressure is constant throughout the thickness of the film. This is considered to be acceptable since the film thickness is only several microns thick.
3. There is no slip at the boundary. This is a standard assumption of fluid dynamics and states that the fluid on a boundary is moving at the same velocity as the boundary.

Several approximations are made during the analysis to simplify the problem. The approximations made here will play a major role in the conclusions drawn at the end of the analysis.

1. The lubricant is Newtonian. A Newtonian fluid is one whose rate of shear is proportional to the stress.
2. The Reynolds number is $<< 1$. This approximation eliminates the inertial effects of the lubricant flow. As will be shown later, the actual Reynolds numbers for the oils are $0.8 < R < 4.0$.
3. The viscosity is considered to be constant throughout the thickness of the film. Since the film is only several microns thick and only motored data was analyzed, the temperature gradient between the liner and piston is considered to be negligible.

The major thrust of this research is to achieve correlation between the film thickness and the lubricant rheology when studied on a cycle by cycle basis. If there is correlation, then the approximations made were valid and conclusions can be drawn accordingly.

CHAPTER 2 - THEORY

2.1 Background

2.1.1 Lubrication Equation

Cameron provides the development of lubrication theory for fluid moving past a wedge. Application of this theory to a moving piston ring requires slight modification. The development of theory relevant to a piston ring begins with the one dimensional Reynolds equation as defined by Cameron:

$$\frac{\partial}{\partial x}\left(h^3\frac{\partial P}{\partial x}\right) = 6U\mu\frac{dh}{dx} \tag{1}$$

2.1.2 Boundary Conditions

Figure 2 defines terms used in the solution of the Reynolds equation for the compression ring of the diesel engine under study. The ring features will be non-dimensionalized later to make the theory applicable to generic piston rings. The boundary conditions used in the solution are simple:

$$P(0) = P_{\text{Crown land}} \tag{2}$$

$$P(b) = P_{\text{Second land}} \tag{3}$$

$$h = h(x) \tag{4}$$

2.2 Non-dimensionalization

2.2.1 Ring Features

The next step is to non-dimensionalize the piston ring features. Several new terms are defined and used throughout the remainder of the analysis. Non-dimensionalization is accomplished by defining:

$$\bar{h} = \frac{h}{h_o} \tag{5}$$

$$\bar{x} = \frac{x}{b} \tag{6}$$

$$\bar{P} = \frac{Ph_o}{6U\mu b} \tag{7}$$

$$\Gamma_1 = \frac{(\delta_1 + h_o)}{h_o} \tag{8}$$

$$\Gamma_2 = \frac{(\delta_2 + h_o)}{h_o} \tag{9}$$

Γ_1 and Γ_2 are not required for the solution of Reynolds equation in non-dimensional terms. They are introduced here because of the significance of the terms in §3.1.

2.2.2 Reynolds equation

Forming the non-dimensional Reynolds equation simply requires substituting equations (5), (6), and (7) into equation (1). By doing so, one obtains the following:

$$\frac{\partial}{\partial \bar{x}} (\bar{h}^3 \frac{\partial \bar{P}}{\partial \bar{x}}) = \frac{d\bar{h}}{d\bar{x}} \tag{10}$$

Non-dimensionalization of the boundary conditions yields the following results for $\bar{h} = \bar{h}(\bar{x}; \Gamma_1, \Gamma_2)$:

$$\bar{h}(0) = \Gamma_1 \ , \ \bar{h}(1) = \Gamma_2 \tag{11}$$

$$\bar{P}(0) = P_1 = (\frac{h_o^2}{6U\mu b}) P_{\text{Crown land}} \tag{12}$$

$$\bar{P}(1) = P_2 = (\frac{h_o^2}{6U\mu b}) P_{\text{Second land}} \tag{13}$$

2.3 Scaling Laws

2.3.1 Bearing Number

After non-dimensionalizing the piston ring features, one must try to connect theory to observed data. This is accomplished by introducing the bearing number, a non-dimensional lift term. The bearing number is derived by examining the lift, W, generated by the piston ring, where;

$$W = \frac{\Delta P B 2\pi R}{2\pi R} \tag{14}$$

and ΔP is the pressure difference across the ring and B is the width of the ring. The lift, W, is the lift generated along the entire circumference of the piston ring. Lift is also defined as the area under the pressure distribution below the ring as shown in equation (15):

$$W = \frac{6U\mu b^2}{h_o^2}\int_0^1 \bar{P}\, d\bar{x} \tag{15}$$

Since equations (14) and (15) are expressions for the lift generated by the ring, they can be equated:

$$\Delta P B = \frac{6U\mu b^2}{h_o^2}\int_0^1 \bar{P}\, d\bar{x} \tag{16}$$

The bearing number, defined as

$$\frac{6U\mu b^2}{\Delta P B h_o^2} = f\left(\Gamma_1, \Gamma_2, P_1, P_2\right) \tag{17}$$

is a function of the inlet and outlet wetting conditions, as well as the pressure loading on the ring.

To eliminate some of the variables, the effect of the pressure loading is theoretically investigated by using a C-language program, *Pressure.c*. This program is similar to the code used by McElwee for predicting the pressure distribution under the piston ring. Its development is outlined in Appendix A. Figure 3 shows a typical pressure distribution for an exhaust stroke. The pressure trace has the non-dimensional axes as discussed in the appendix. Of particular note is the maximum value of the non-dimensional pressure (~0.04). Since P_1 and P_2 are on the order of 10^{-3} for any given film shape, the load varies by only 2-4%. Therefore, the bearing number (N) is reduced to a function only of the inlet and outlet ring wetting dimensions:

$$N = \frac{6U\mu b^2}{\Delta P B h_o^2} = f(\Gamma_1, \Gamma_2) \tag{18}$$

Equation (18) implies that if our the initial assumptions and approximations are valid, then the bearing number should be a function of only inlet and outlet variability.

2.3.2 Drag

The development of the equations for the friction force (drag) is according to Cameron. It begins with the definition of a Newtonian fluid:

$$\tau = \mu \frac{\partial u}{\partial z} \tag{19}$$

Cameron continues to develop the shear stress relationship and arrives at equation (20) in dimensional terms.

$$\tau(x) = \frac{\mu U}{h(x)} - \frac{\partial P}{\partial x}\frac{h(x)}{2} \tag{20}$$

The drag force is obtained by integrating the shear stress over the length of contact:

$$D = \int_0^b \tau(x)\, dx \tag{21}$$

Finally, the drag force is placed in non-dimensional terms:

$$C_D = \left(\frac{h_o}{U\mu b}\right) D \tag{22}$$

To correlate the drag on the ring, the coefficient is analyzed to be a function of the inlet condition. This will provide a relationship for drag on the ring in terms of the inlet condition similar to the bearing number:

$$C_D = f(\Gamma_1) \tag{23}$$

CHAPTER 3 - RESULTS

3.1 Exhaust Stroke

3.1.1 Difference between lubricants

Figure 4 depicts the inlet variability of each of the five oils tested. Note the difference in magnitude of the inlet condition for each oil. The single-grade oils appear to wet the ring more than the multi-grade oils do. The error bars are an indication of the maximum and minimum values of inlet ring wetting. These two observations are the essence of the difference between single and multi-grade lubricants.

3.1.2 Bearing Number versus Γ_1

Figure 5 is a plot of inlet variability versus the bearing number. The data points plotted are for the exhaust strokes of all five oils. The data points correlate to a fairly high degree. Although the data points appear to be linear, it is not discernable that the data cannot be segregated by lubricant type or if inertial effects account for the spread in the data.

Figure 6 explores the possibility whether the data can be segregated by lubricant type or not. Data for each of the five oils under investigation is equally distributed throughout the spread. This indicates that the type of lubricant is not an important factor. Each of the five oils exhibit Newtonian behavior under the top ring.

Figure 7 examines the possibility that inertial effects account for the separation of data. The inlet variability is plotted against bearing number for different ranges of Reynolds number. No apparent division of data due to Reynolds number is observed. This indicates that inertial effects do not influence the Newtonian characteristics of the oil film.

Figures 5-7 show that the fluid under the rings is Newtonian and the effects are independent of lubricant type and inertia. If the oil was not Newtonian, one would expect complete scatter of the data with no correlation evident in any of these figures.

The straight line correlation between Γ_1 and bearing number is expressed in the following equation:

$$\Gamma_1 = 1.1138 + 4.8412 \times 10^{-3} N \tag{24}$$

where N is the bearing number.

3.1.3 Γ_1 versus Γ_2

The results in §3.1.2 show that the fluid under the top ring is Newtonian. However, the theory developed earlier predicts that the bearing number is not simply a function of the inlet condition but the outlet condition as well. Figure 8 is a plot of the inlet versus outlet variability. It would simplify the theory greatly if there was a direct correlation between the inlet and outlet film conditions, but Figure 8 does not show any correlation. One reason that this correlation is not readily apparent, is because the outlet condition is the most difficult ring feature to place during the data analysis. The inlet condition is well defined, as is the minimum oil thickness. The outlet condition is often a subjective placement due to the fluorescent signal provided. In the analysis, the placement of the ring was made consistently from cycle to cycle, however, the subjective nature of the outlet condition no doubt accounts for some of the data scatter.

The possible correlation between the inlet and outlet condition is examined in the following section.

In order to explore the relationship between the inlet and outlet wetting condition, several random exhaust stroke film traces were profiled. Figure 9 shows the digitized ring contour of the film traces. The contours have been non-dimensionalized as discussed previously. From these contours, several observations can be made:

1. The inlet condition plots as x(0) and the outlet condition as x(1).
2. The minimum non-dimensional film thickness occurs at x(0.6) and equals one, as expected.

These observations were used to calculate a generic second-order polynomial contour for a values of Γ_1 shown in Figure 10. These values of inlet wetting were chosen to be representative of the data and provide a number of values in order to perform various calculations. The coefficients of the second-order polynomial were entered as input into Pressure.c. This process was repeated with different values of Γ_2 until the bearing number from Pressure.c matched that of the observed data exactly. The final values of Γ_2 which predicted the observed bearing number are shown in Table 1.

Table 1

Γ_1	Γ_2	Γ_1/Γ_2
1.35	1.074	1.26
1.70	1.39	1.22
2.10	1.705	1.23
2.60	2.095	1.24

Table 1 provides valuable information concerning the behavior of the lubricant as it wets the ring. The relationship between inlet and outlet conditions is a constant value, so the bearing number can be reduced to a function of a single variable:

$$\frac{6U\mu b^2}{\Delta P B h_o^2} = f(\Gamma_1) \tag{24}$$

Figure 11 shows that the relationship between inlet and outlet conditions falls within the data generated.

3.1.5 Drag

The non-dimensional drag coefficient for each of the four values of Γ_1 derived in Figure 10 have been plotted in Figure 12. This figure implies that the drag on the top ring increases as Γ_1 decreases. A third order polynomial curve fit passes through the data with excellent correlation. The equation of this fit provides a means to predict drag for a given value of Γ_1.

$$\Gamma_1 = 65.765 - 186.83C_D + 179.47C_D^2 - 57.034C_D^3 \qquad (25)$$

3.2 Compression Stroke

An identical analysis was performed on the compression strokes for the 5 oils at each of the operating conditions as that performed on the exhaust strokes. Figures 13-16 highlight the results of this analysis. Several items are worth noting when reviewing the results of the compression stroke data analysis.

1. Figure 13 outlines the differences between oils for the compression stroke.

2. The Newtonian correlation is still evident is Figure 14. Again, no segregation of oil type can be made nor are there any inertial effects present in the compression stroke data. The relationship between Γ_1 and the bearing number is determined to be:

$$\Gamma_{1(COMP)} = 1.3124 + 5.9157x10^{-3}N \qquad (26)$$

3. The relationship between inlet and outlet wetting shifts slightly for the compression strokes. This relationship is 1.4:1 for the compression data.

4. The drag coefficient showed a similar trend for the compression strokes. Once again, Γ_1 and drag are inversely related.

3.3 Other Strokes

An investigation of the properties of the downstrokes was also performed for each of the five lubricants. This analysis is not as detailed for several reasons. The

typical film trace of a downstroke is shown in Figure 17. Note the relatively flat region in the area of the ring groove (-9.5 mm to -11.5 mm). The flatness of the film trace is not distinctive enough in its features to allow the ring contour to be accurately placed. The ring, in these cases, appears to ride over the film and not be fully wetted by the oil.

The analysis was conducted in an effort to determine three characteristics of the downstrokes:

1. The relationship between Γ_1 and Γ_2,
2. Differences between lubricants, if any, and
3. To determine if enough lift is generated to support the ring.

The analysis shows that the compression ring is not fully flooded on the downstrokes. The oil does not wet the ring above the ring face contour as consistently as it wets the ring on the upstrokes. Several digitized film traces were examined and the relationship between Γ_1 and Γ_2 is 1.05:1. This relationship is much different that that for the upstrokes.

The relationship between Γ_1 and Γ_2 suggests that the inlet and outlet wetting are very nearly the same. In each of the five oils this numerical relationship is consistent Some oils display slightly thicker films but maintain the established connection between Γ_1 and Γ_2 .

Each of the film traces examined were digitized and polynomial fits obtained in the same manner as in §3.1.3. The engine operating conditions and film characteristics were entered into Pressure.c in order to determine the lift in each case. A positive lift for a majority of the cases was obtained indicating that the film trace can still support the ring. Several values of negative lift were obtained. This is due to the small difference between Γ_1 and Γ_2 . In these cases the digitized profile of the trace showed that the outlet wetting was slightly higher (~0.1 - 0.2 μm) than the inlet condition. This gives negative lift but is well within the accuracy of the data.

CHAPTER 4 - CONCLUSIONS

The results described in §3 show that the approximations made during theory development were valid. Some very interesting conclusions may be drawn about the data analysis performed for the 5 lubricants:

1. The lubricant under the compression ring is Newtonian. This conclusion is reached *independent* of lubricant type (single or multi-grade).

2. The primary difference between lubricants is the manner in which the ring is wetted. The single-grade oils appear to wet the ring more thoroughly than the multi-grades.

3. The minimum oil film thickness typically occurs at a point 60% from the inlet wetting point on the ring. This permits calculation of the film contour and prediction of the bearing number.

4. There is a consistent linear relationship between the inlet to outlet wetting conditions of ~ 1.24 for exhaust strokes. This relationship is approximately 1.39 to 1 for compression strokes.

5. The linear relationships between Γ_1 and bearing number (N) vary with the type of stroke and are defined as follows:

$$\Gamma_{1(EXH)} = 1.1138 + 4.8412 \times 10^{-3} N$$

$$\Gamma_{1(COMP)} = 1.3124 + 5.9157 \times 10^{-3} N$$

6. The relationship between Γ_1 and Γ_2 for the downstrokes is 1.05:1. This suggests that the ring is just skimming the oil film. Even if this is the case, there is still enough lift generated to support the ring.

7. Non-dimensional drag is inversely proportional to inlet wetting. As Γ_1 increases, drag is reduced. This trend is consistent for both exhaust and compression strokes. A third-order polynomial curve fit describes this relationship.

$$\Gamma_1 = 65.765 - 186.83C_D + 179.47C_D^2 - 57.034C_D^3$$

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FIGURES

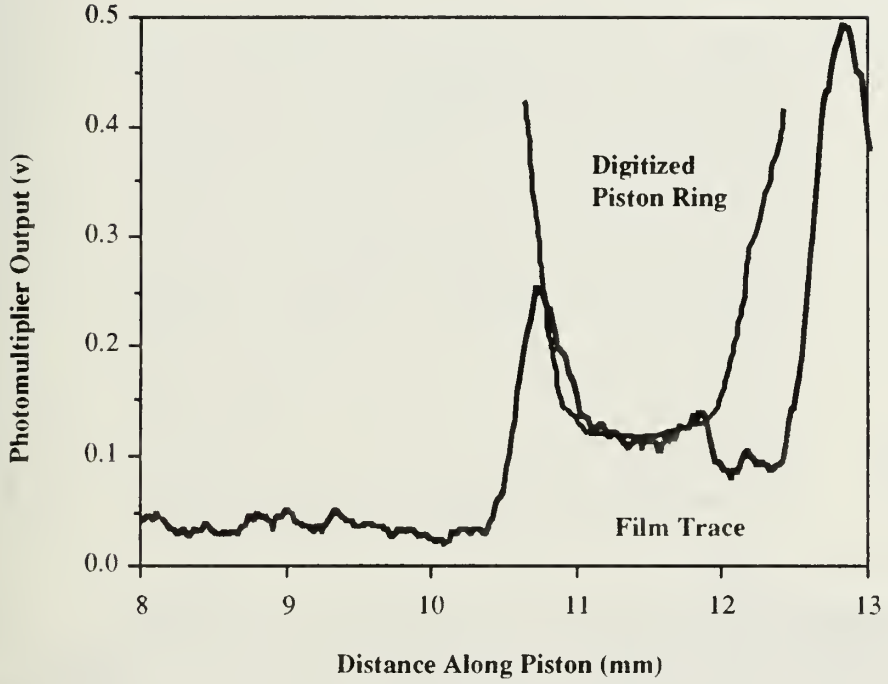
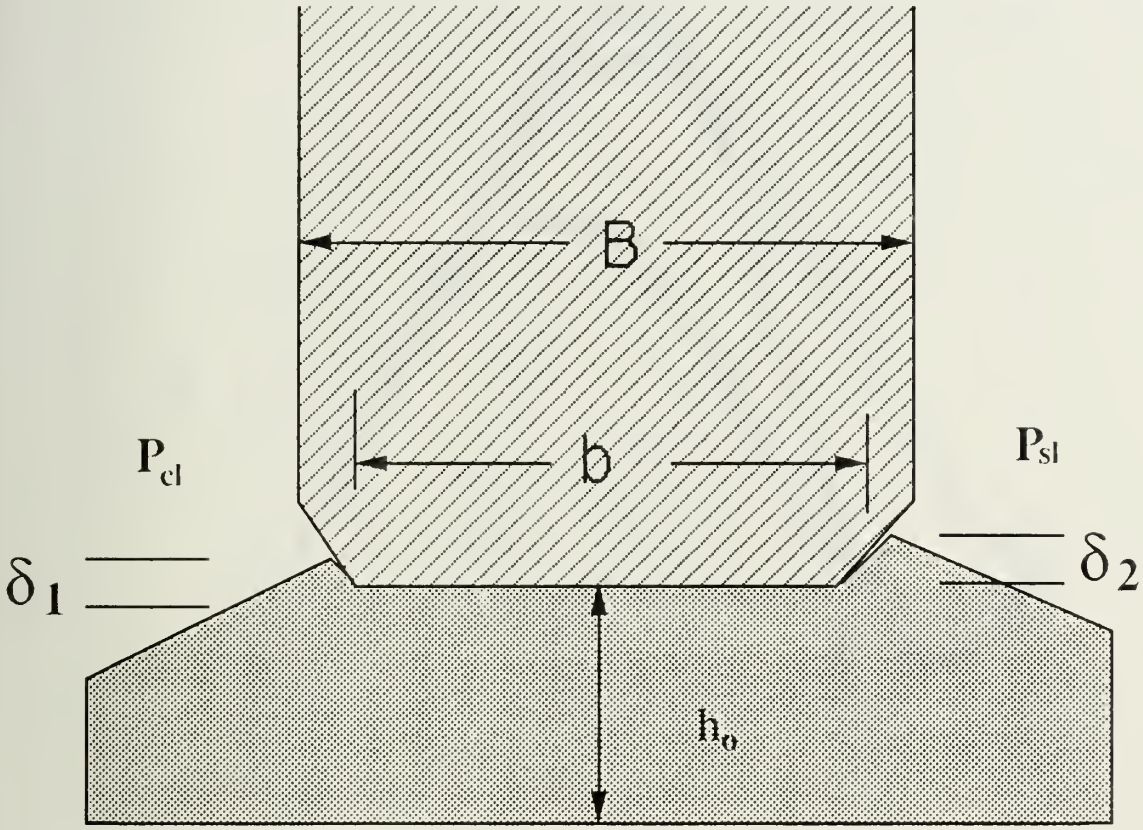


Figure 1 - Schematic of method used to place the ring on an individual film trace. Each revolution was examined in this manner and the data recorded in a spreadsheet (see Appendix B).



$$\Gamma_1 = \frac{(\delta_1 + h_o)}{h_o} \qquad \Gamma_2 = \frac{(\delta_2 + h_o)}{h_o}$$

Figure 2 - Definition of terms used in the solution of the Reynold's equation for the lubricant under the compression ring.

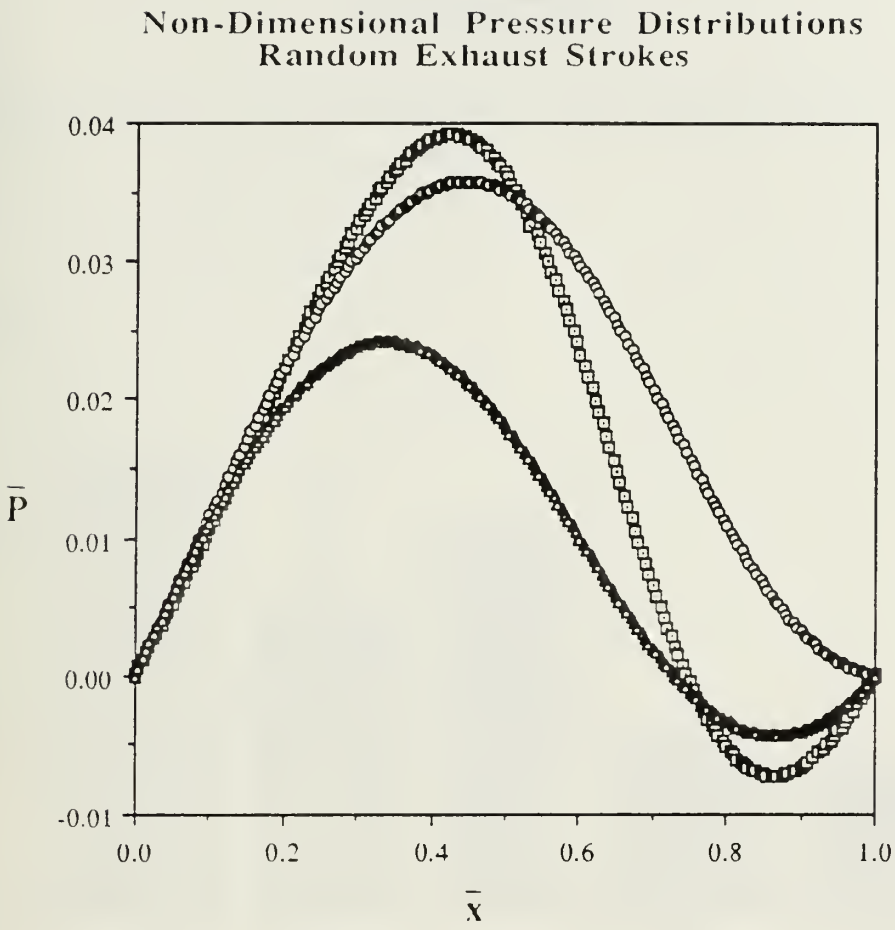


Figure 3 - Non-dimensional pressure distributions under three randomly selected wetted ring contours. Note that the value of P bar is ~0.3 - 0.4 for any selected contour. This, combined with the fact that P1 and P2 are on the order of 0.001, eliminate the pressure difference as a major contributor to the bearing number.

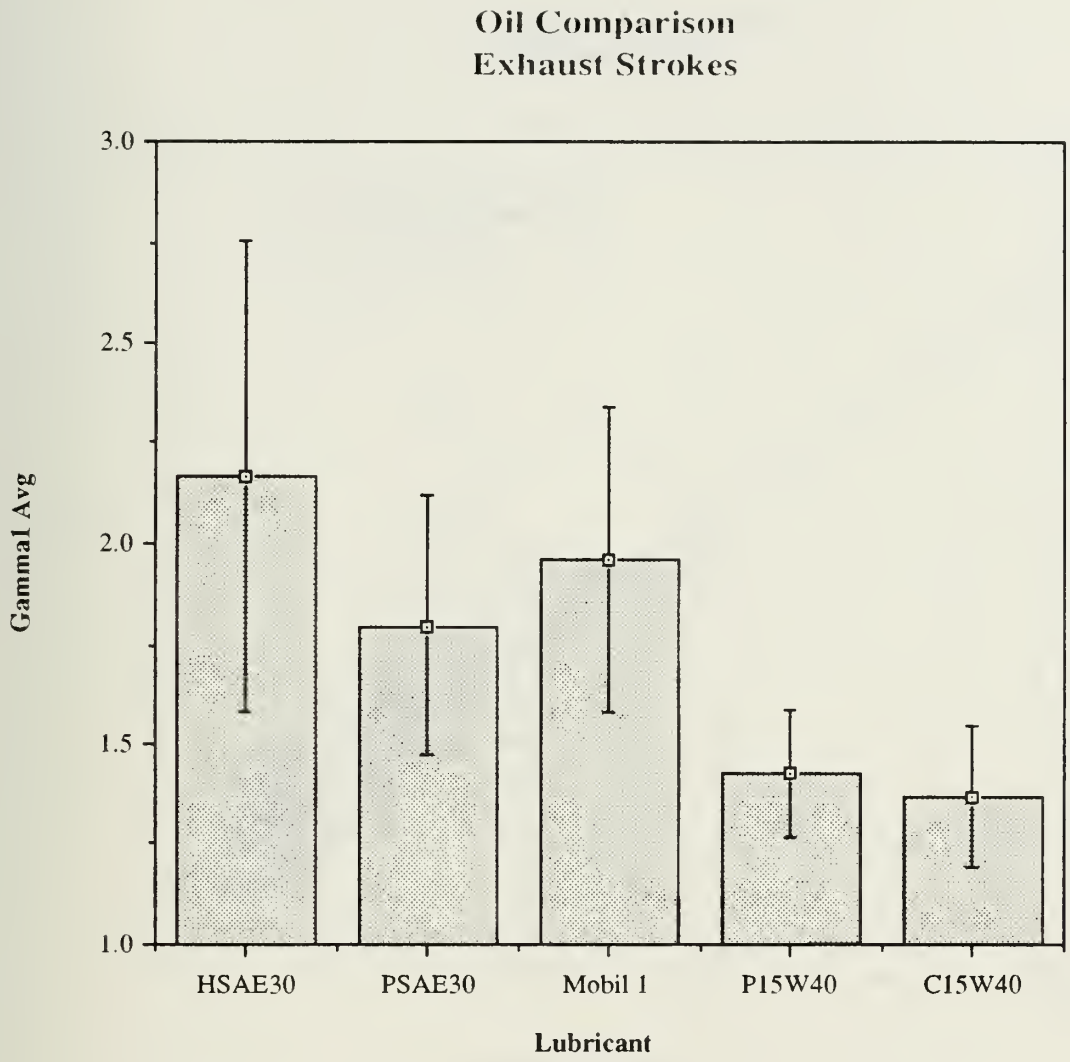


Figure 4 - Comparison of inlet variability for the five lubricants under investigation. Notice that the single-grade oils appear to "wet" the ring more than the multi-grades do.

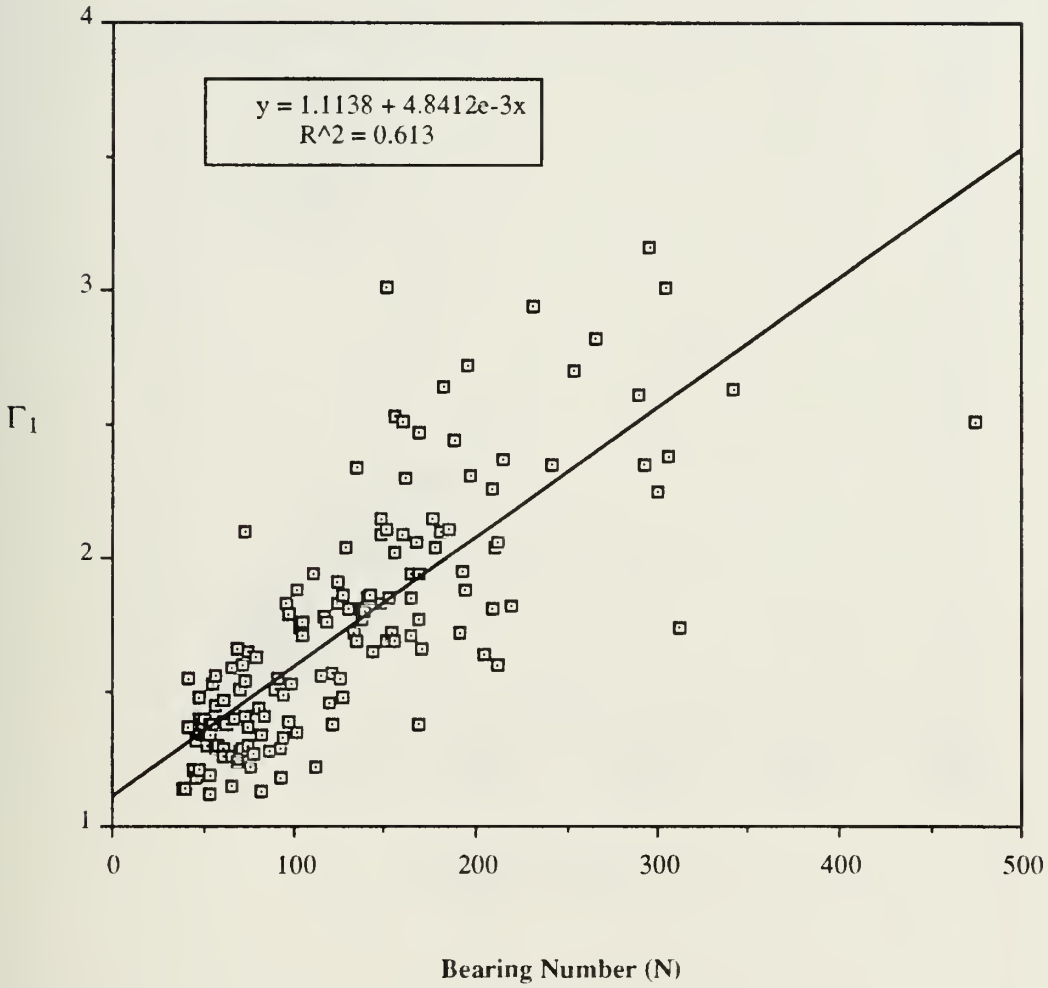


Figure 5 - Inlet variability plotted versus bearing number (N). Notice the correlation which demonstrates the Newtonian behavior of the lubricant under the compression ring.

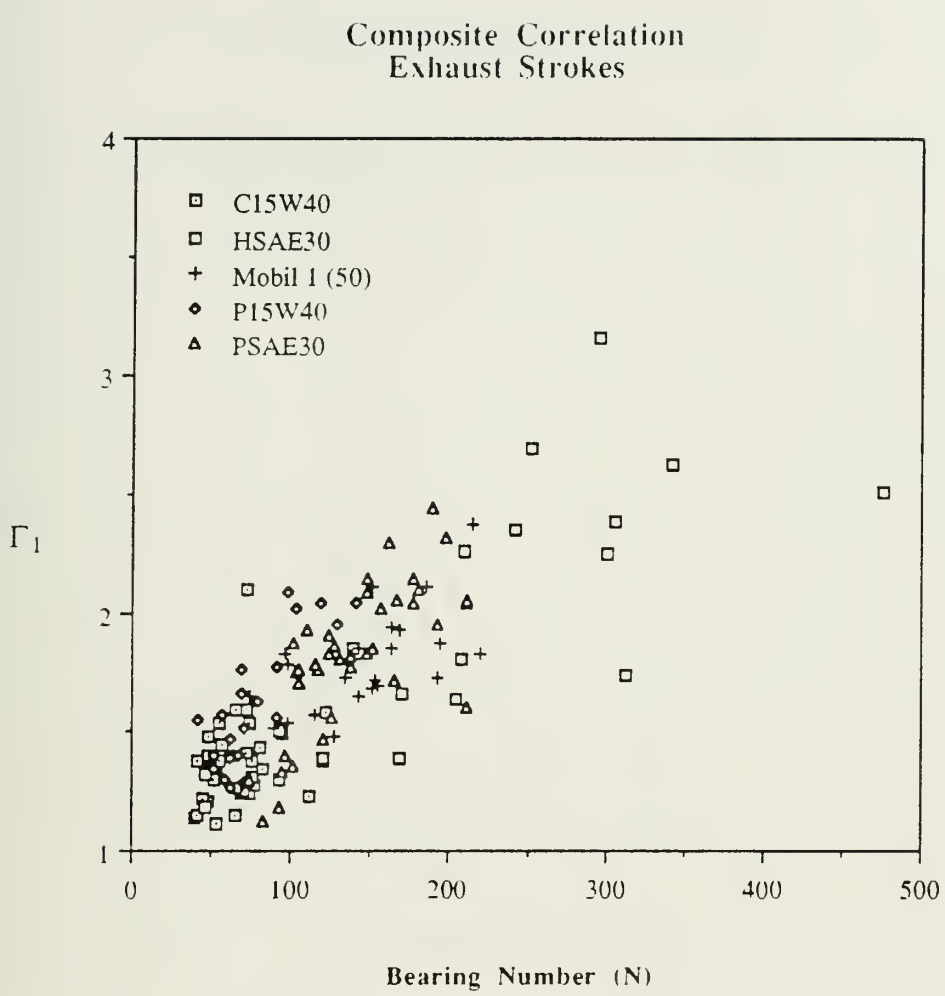


Figure 6 - Inlet variability plotted versus the bearing number (N) and data separated by lubricant type. Notice that there is no observable difference between the single-grade or multi-grade oils when plotted in this fashion.

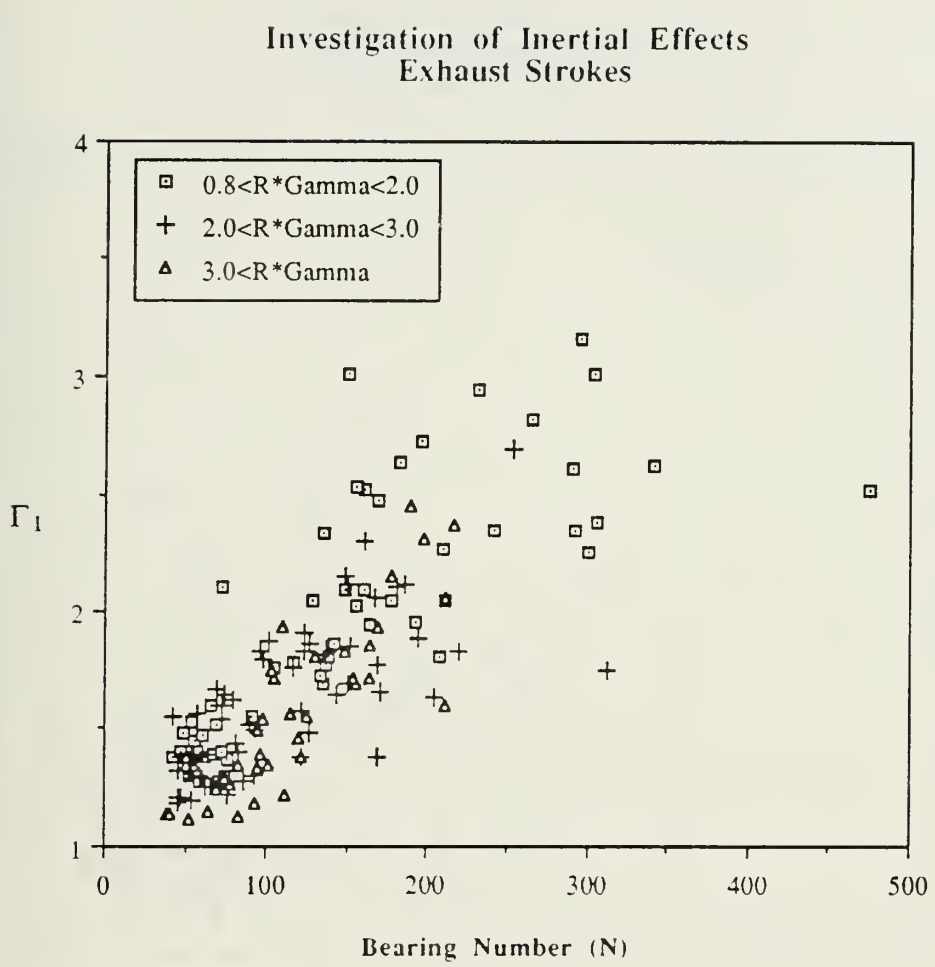


Figure 7 - Plot of bearing number (N) versus inlet variability with data separated by Reynolds number. Notice that there is no apparent grouping of data due exclusively to inertial effects.

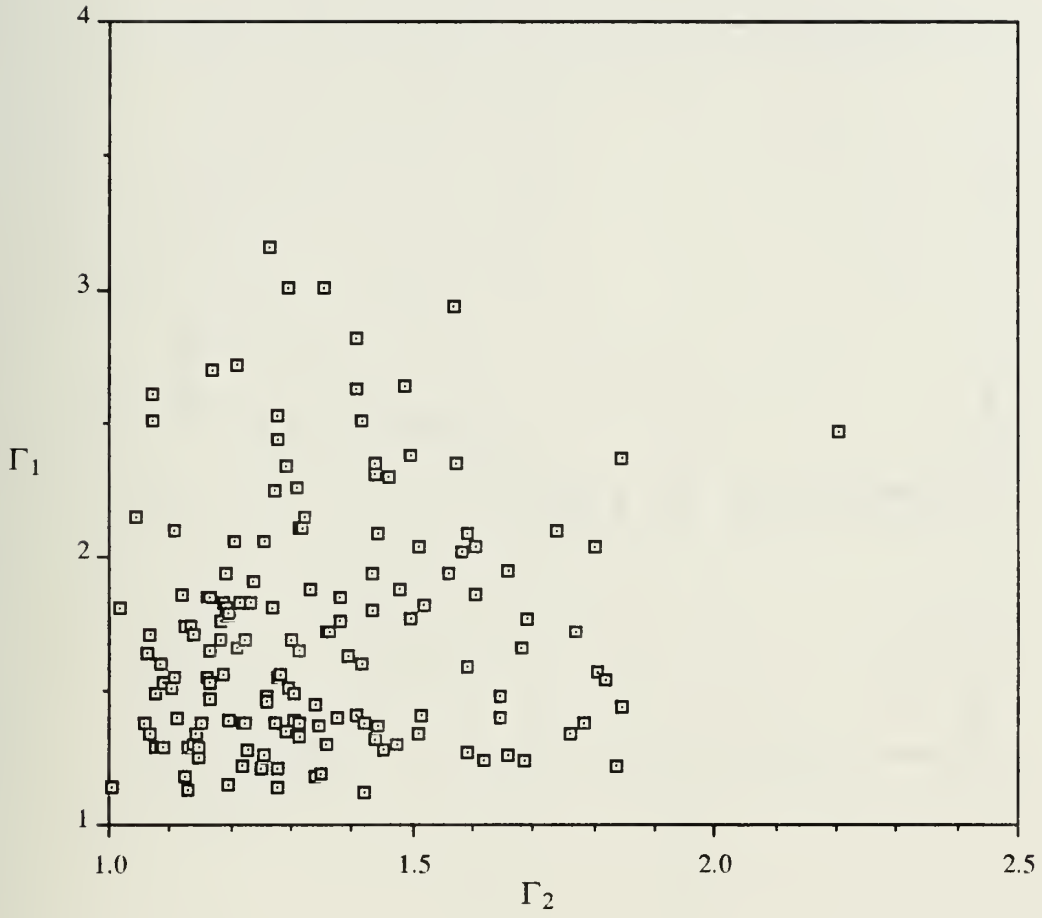


Figure 8 - Plot of inlet variabilitry versus outlet variability. The data scatter is due mainly to the difficulty in placing the ring with respect to the outlet film trace.

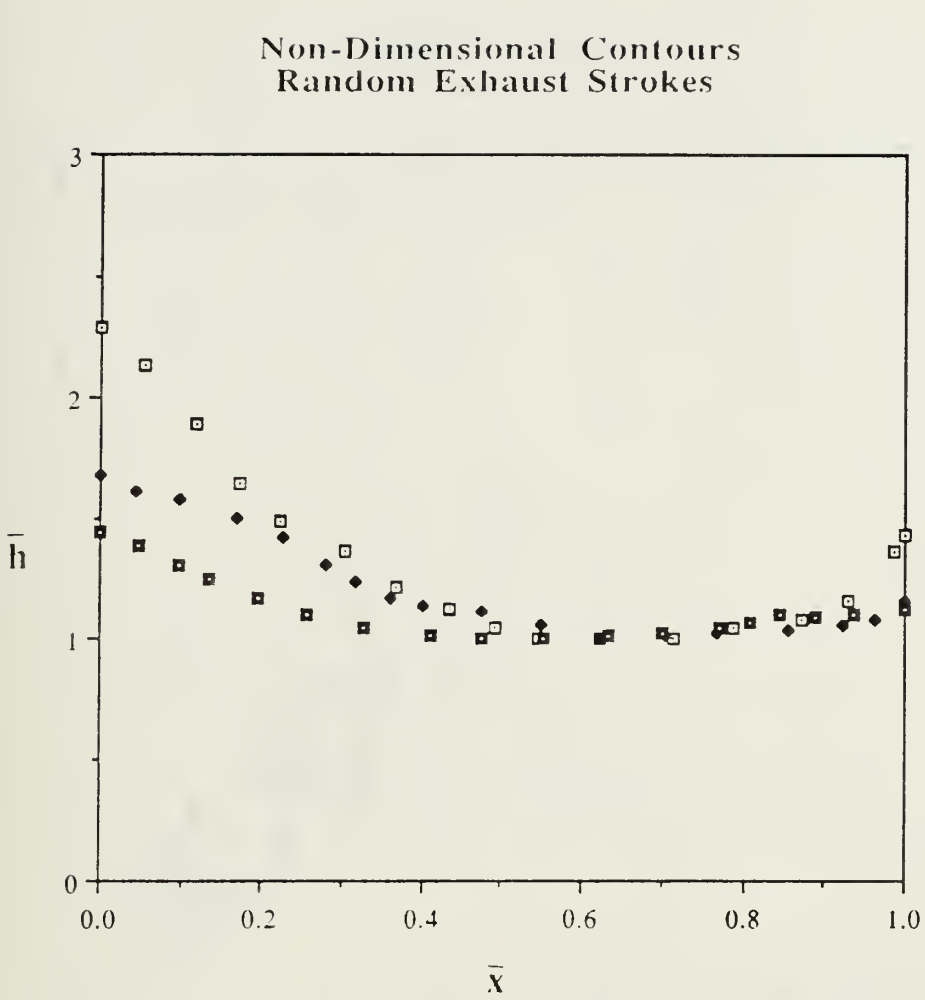


Figure 9 - Random ring contours of film traces from several exhaust strokes. Note that the minimum value of h bar (minimum oil film thickness) appears to occur at 0.6 consistently.

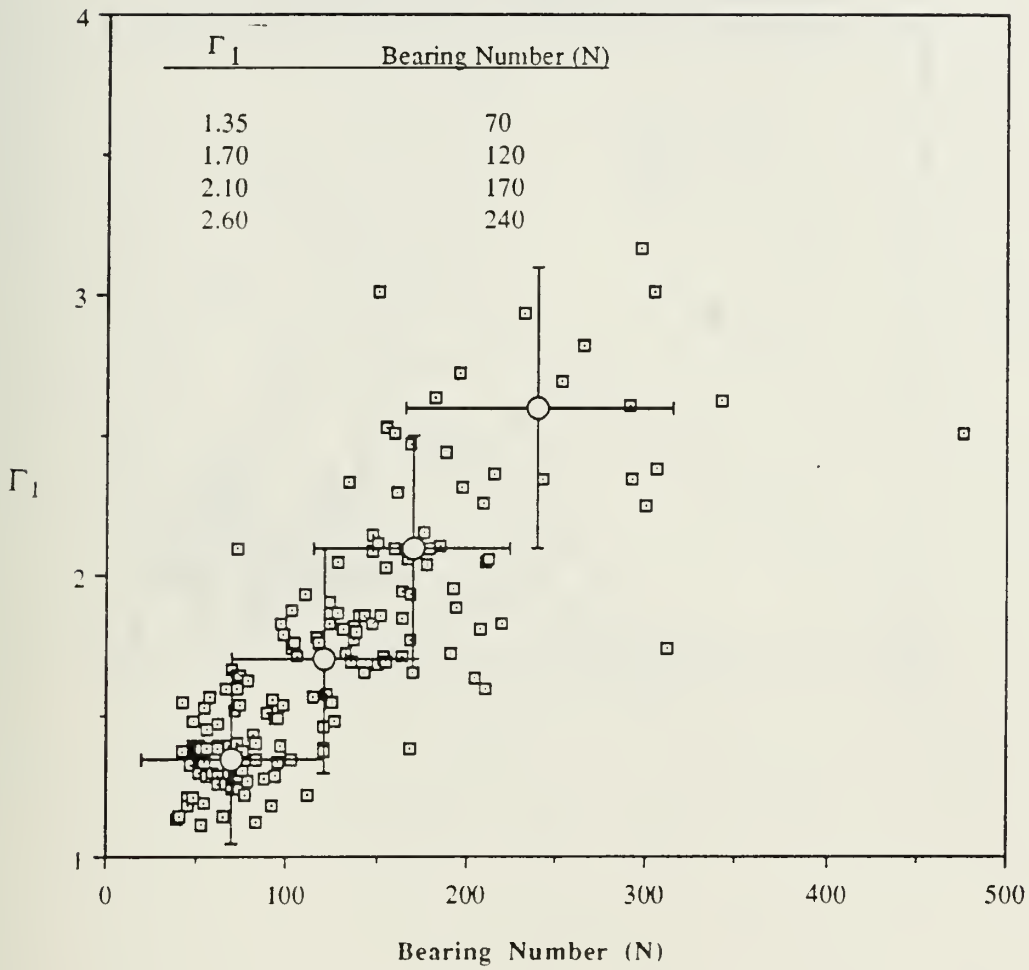


Figure 10 - Plot of inlet conditions versus bearing number (N) showing the methodology for selecting representative values of inlet wetting to be used in further calculations.

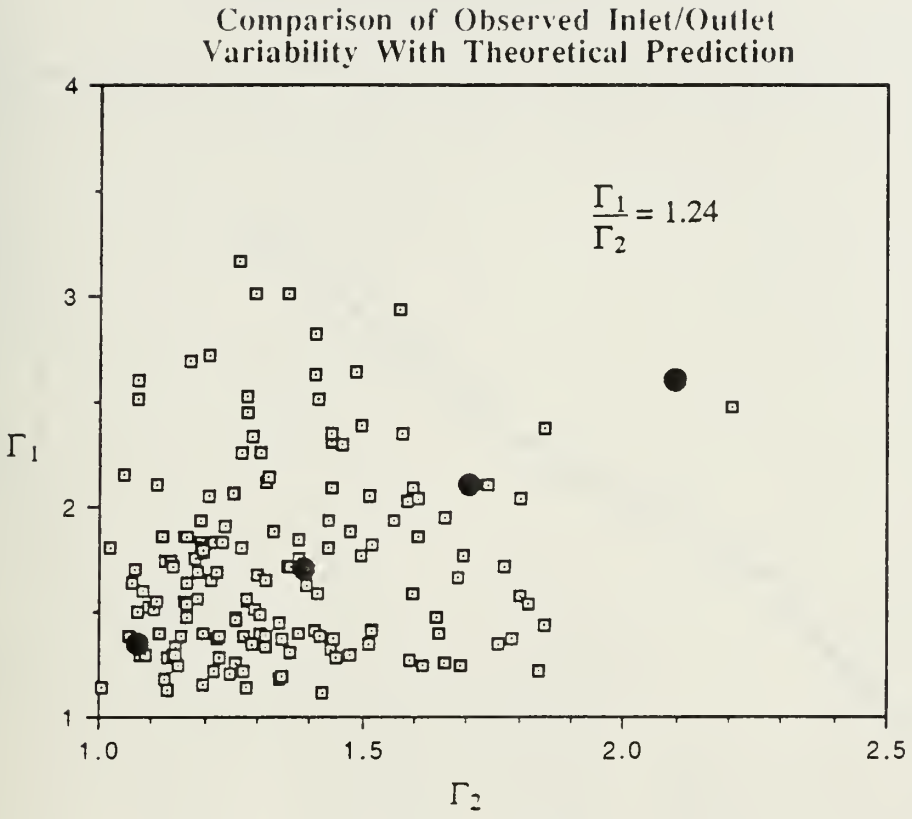


Figure 11 - Plot of the inlet versus outlet variability with the relationship predicted by theory overlaid. The large points are the theoretical prediction with the relationship shown.

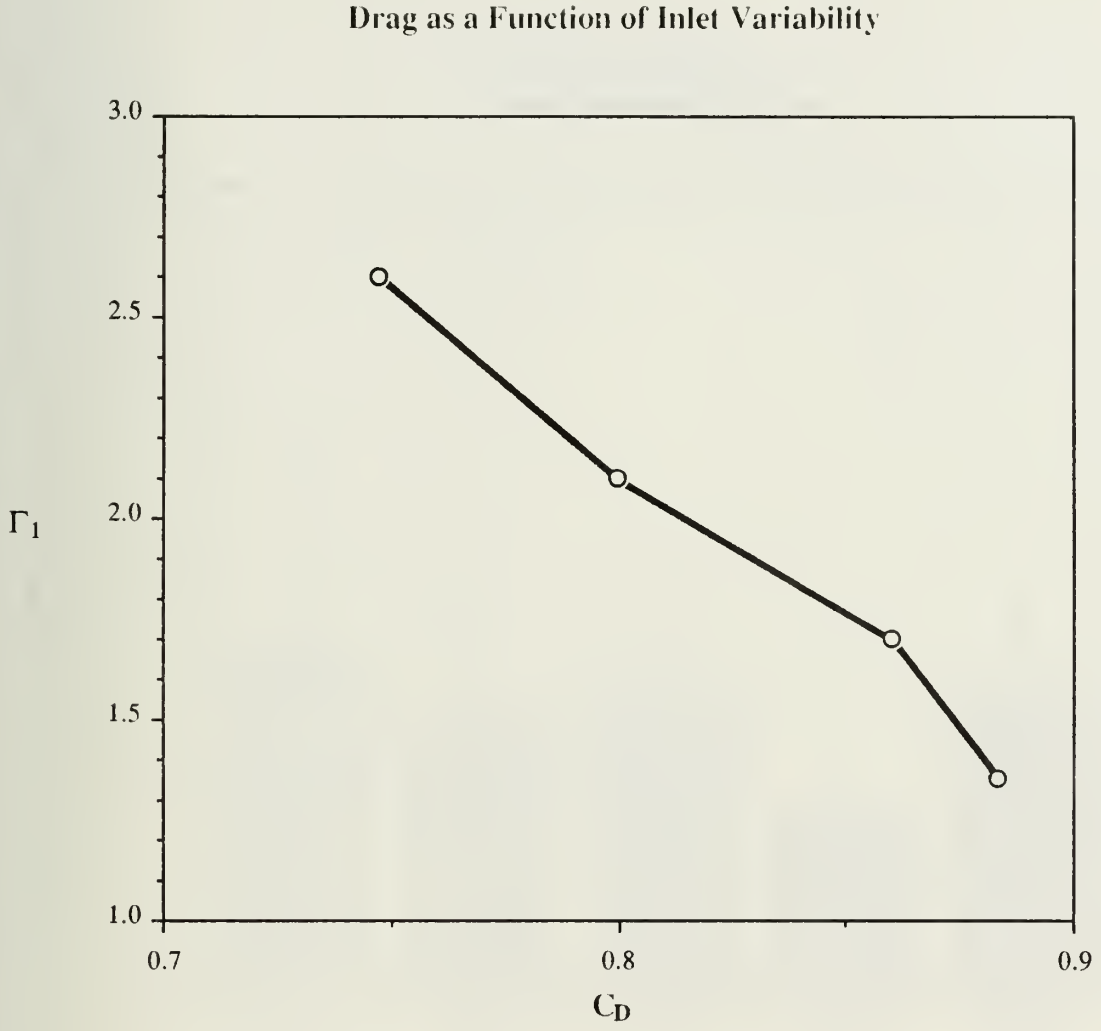


Figure 12 - Non-dimensional drag plotted as a function of inlet conditions. Notice that as Gamma1 gets larger the drag on the ring is reduced.

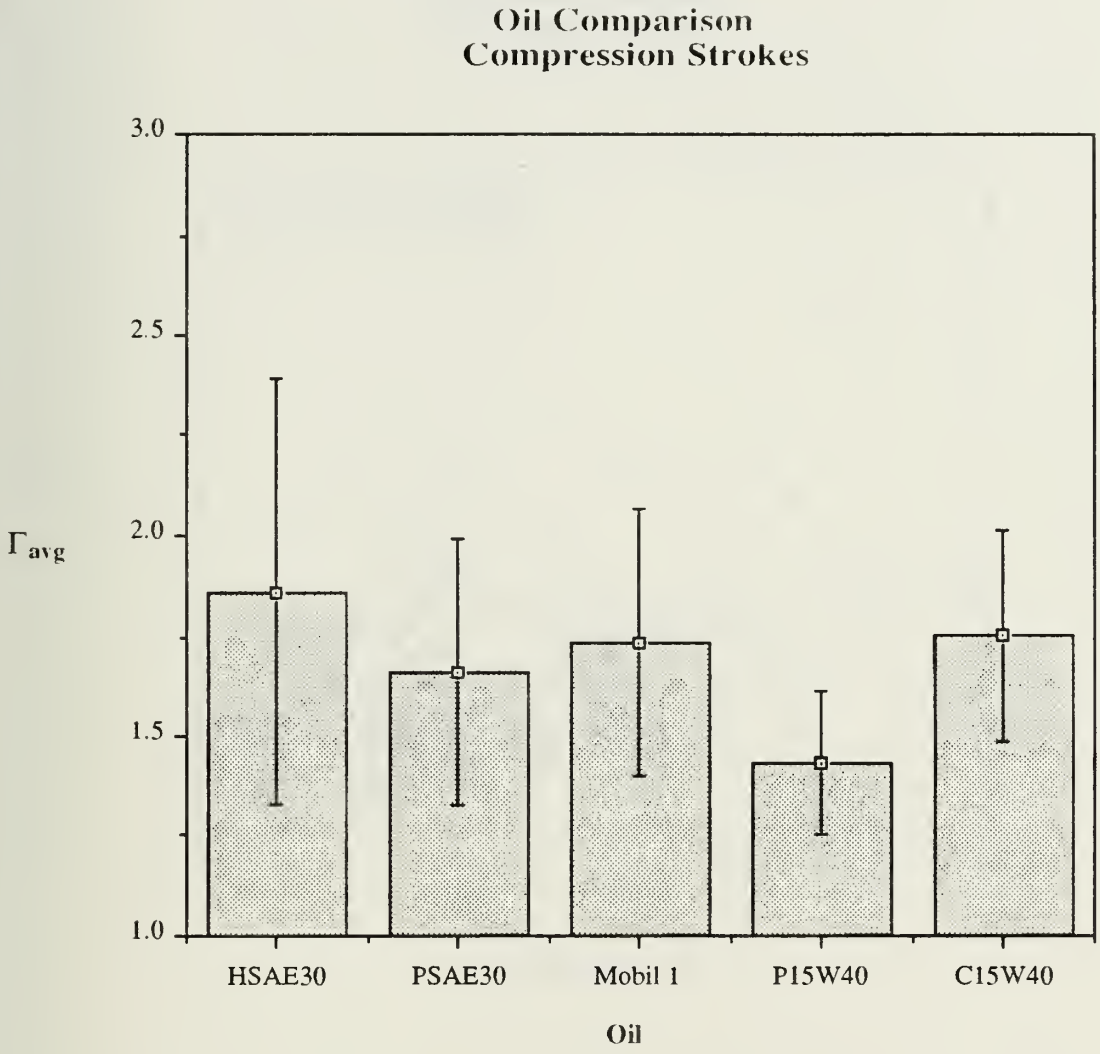


Figure 13 - Comparison of inlet variability versus lubricant type for each of the five oils tested. This is the same analysis that was done for the exhaust strokes as shown in Figure 4.

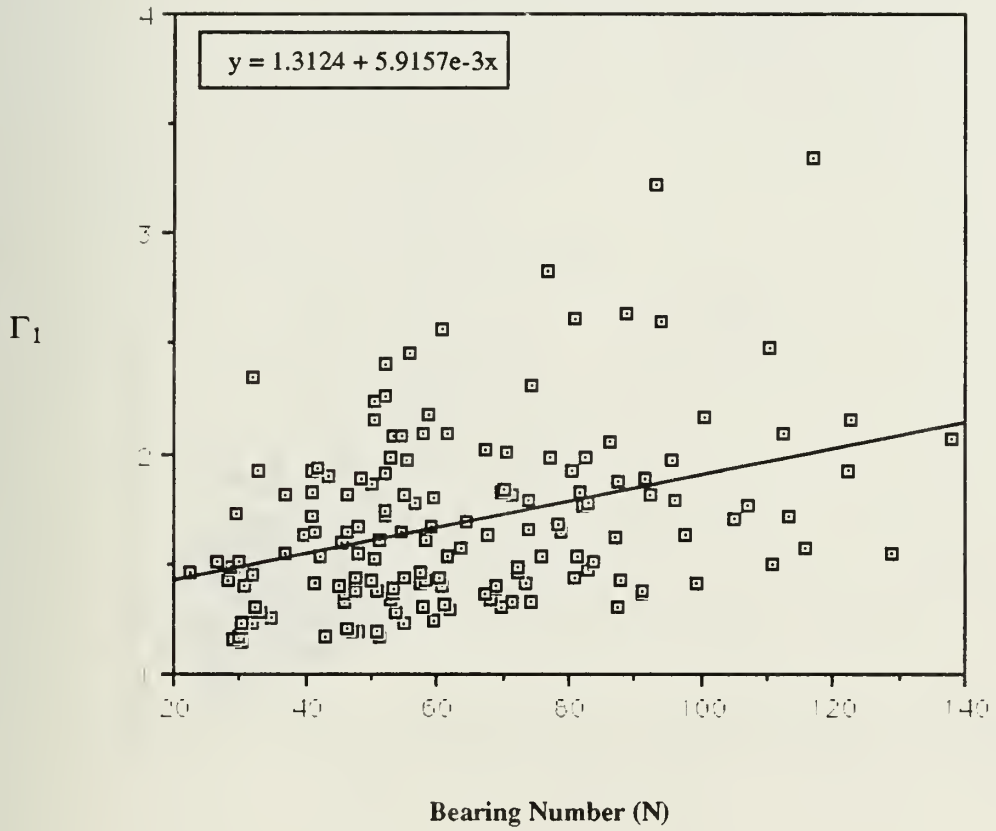


Figure 14 - Inlet variability plotted versus bearing number (N) for the compression strokes. Notice the Newtonian correlation which is present similar to that of the exhaust strokes in Figure 5.

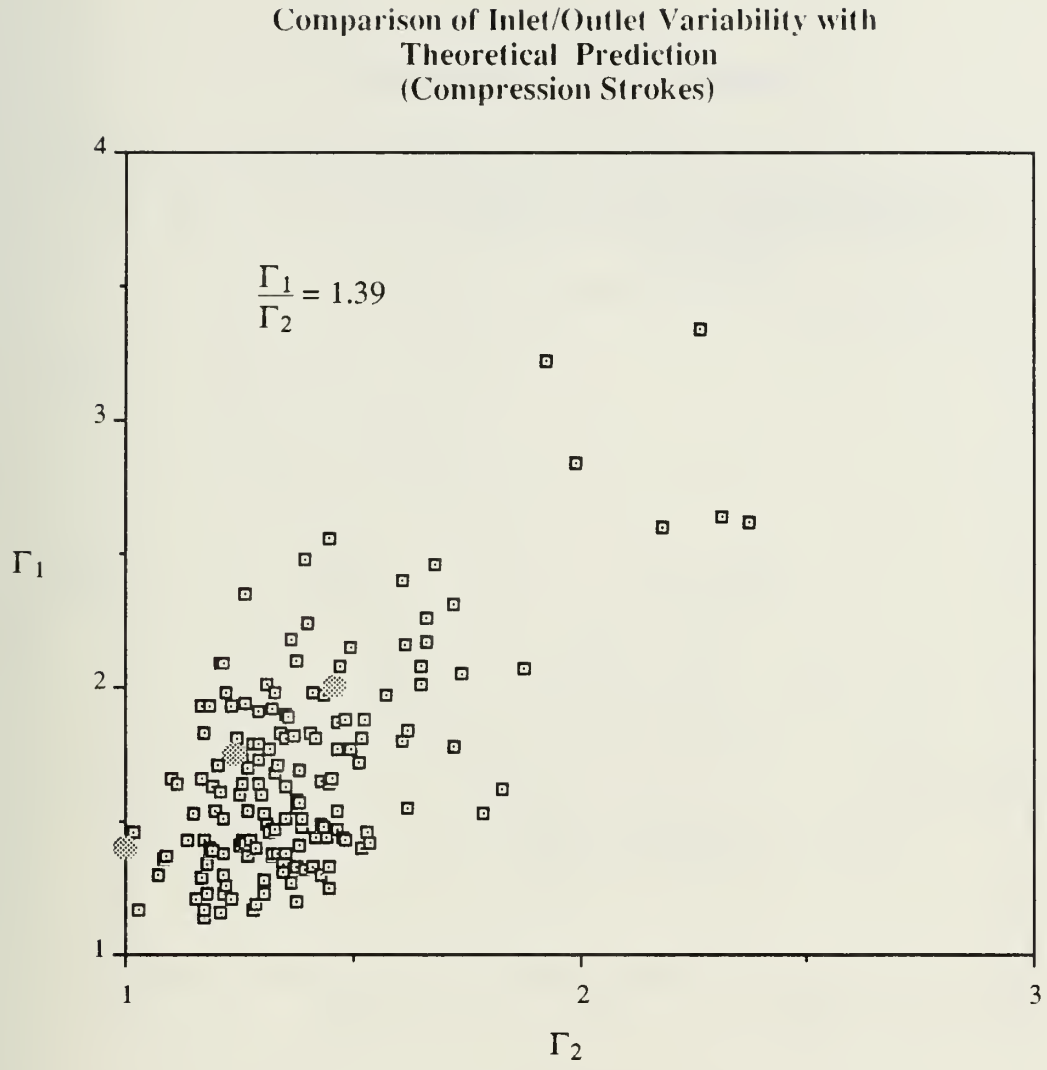


Figure 15 - Plot of inlet wetting versus outlet variability for each of the compression strokes. The overlay points are the predicted values of outlet wetting for a specified value of inlet wetting. The relationship is shown above.

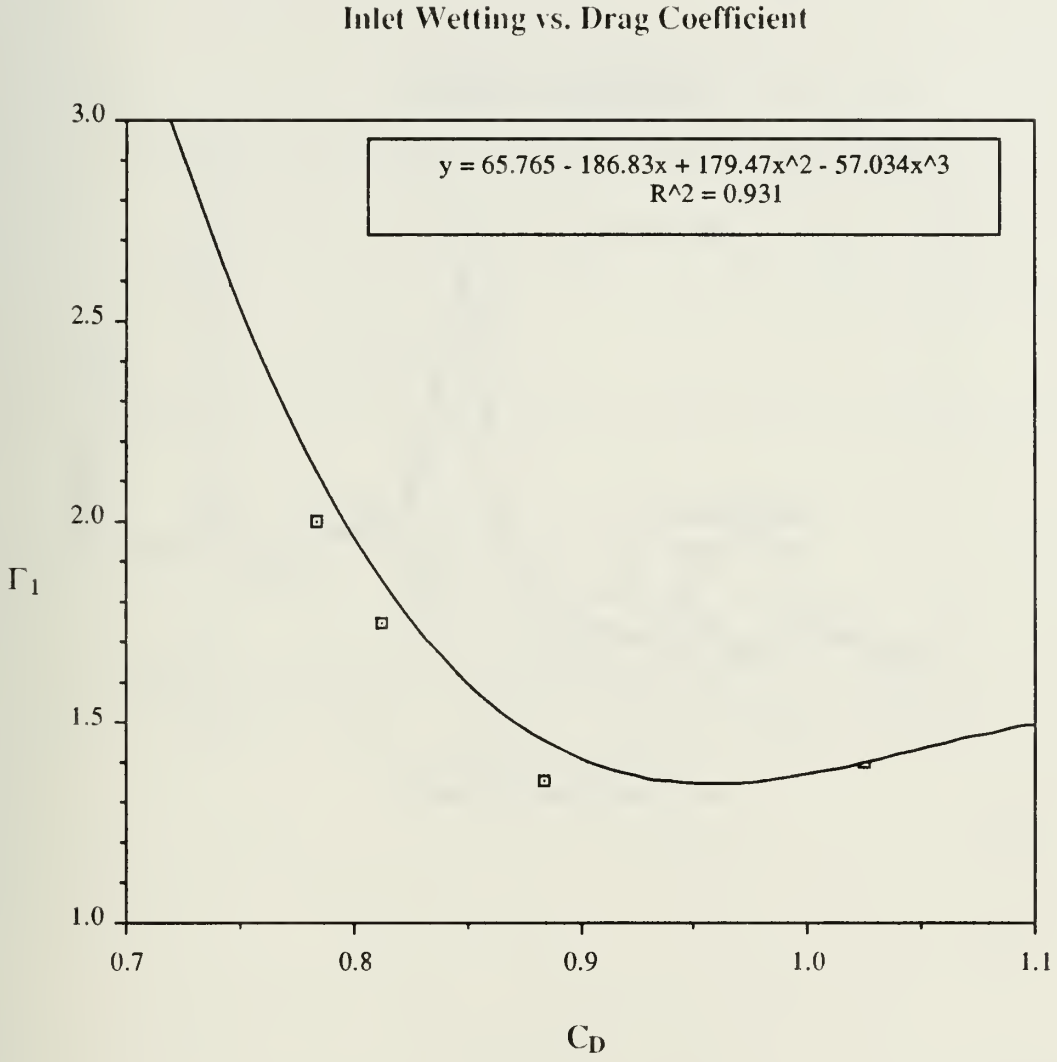


Figure 16 - Drag coefficient for the compression strokes added into Figure 12 (exhaust strokes). Note the increase in drag coefficient as inlet wetting decreases. The curve fit is a third-order polynomial with very good correlation.

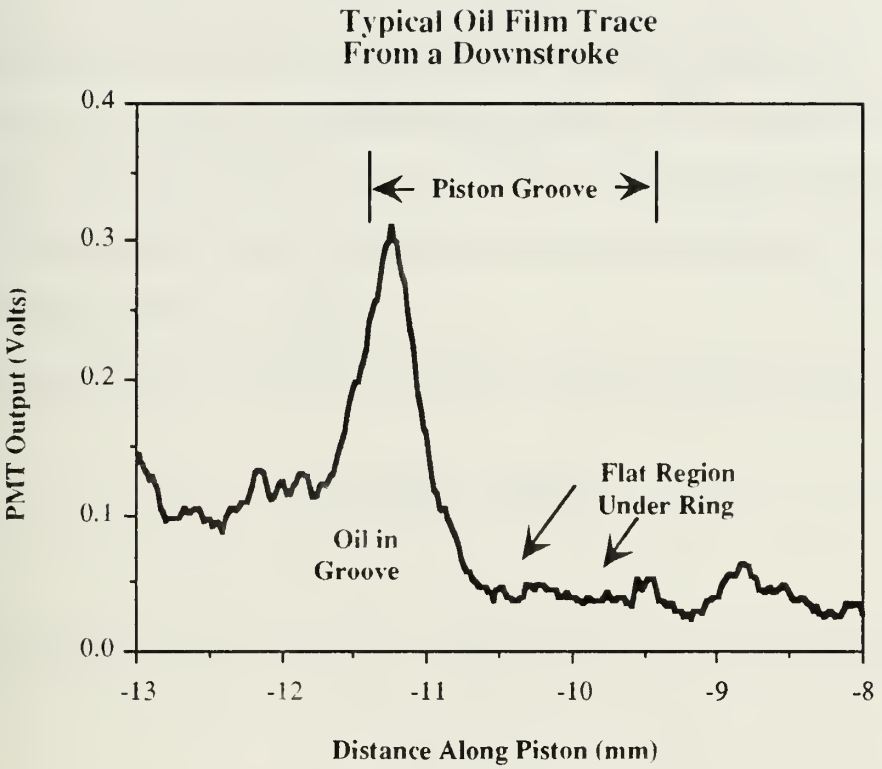


Figure 17 - Typical downstroke film trace for any lubricant. The ring groove is from -9.5mm to -11.5mm. The lump of oil at ~-11.5mm is in the ring groove and the flat region at ~-10mm is under the ring. There is no distinct ring feature that can be used to accurately place the ring.

APPENDIX A - Development of Pressure.c

This appendix describes the solution of the one dimensional Reynolds equation using a centered finite-difference approximation. This solution was used to develop the C-language program, Pressure.c, which is included at the end of this appendix. The equation numbers used in the comment lines of Pressure.c correspond to the following development scheme.

Development begins with the one-dimensional Reynolds Equation from Cameron :

$$\frac{\partial}{\partial x}\left(h^3\frac{\partial P}{\partial x}\right) = 6U\mu\frac{dh}{dx} \tag{A1}$$

Non-dimensionalization of (A1) is accomplished with the following definitions:

$$\bar{h} = \frac{h}{h_o} \tag{A2}$$

$$\bar{x} = \frac{x}{b} \tag{A3}$$

$$\bar{P} = \frac{Ph_o^2}{6U\mu b} \tag{A4}$$

$$\Gamma_1 = \frac{(\delta_1 + h_o)}{h_o} \tag{A5}$$

$$\Gamma_2 = \frac{(\delta_2 + h_o)}{h_o} \tag{A6}$$

Substituting (A2), (A3), and (A4) into (1), the following non-dimensional Reynolds equation is obtained:

$$\frac{\partial}{\partial \bar{x}}\left(\bar{h}^3 \frac{\partial \bar{P}}{\partial \bar{x}}\right) = \frac{d\bar{h}}{d\bar{x}} \tag{A7}$$

Expanding the left hand side of (A7):

$$\bar{h}^3 \frac{\partial^2 \bar{P}}{\partial \bar{x}^2} + 3\bar{h}^2 \frac{\partial \bar{h}}{\partial \bar{x}} \frac{\partial \bar{P}}{\partial \bar{x}} = \frac{d\bar{h}}{d\bar{x}} \tag{A8}$$

Divide both sides by $\bar{h}^3$:

$$\frac{\partial^2 \bar{P}}{\partial x^2} + \frac{3}{\bar{h}} \frac{\partial \bar{h}}{\partial x} \frac{\partial \bar{P}}{\partial x} = \frac{1}{\bar{h}^3} \frac{d\bar{h}}{d\bar{x}} \tag{A9}$$

The non-dimensional contour of the film trace is approximated by a second-order polynomial in the form of :

$$\bar{h}(\bar{x}) = A + B\,\bar{x} + C\bar{x}^2 \tag{A10}$$

Therefore,

$$\frac{d\bar{h}}{d\bar{x}} = B + 2C\bar{x} \tag{A11}$$

Substituting (10) and (11) into (9), the following are obtained:

$$\frac{\partial^2 \bar{P}}{\partial \bar{x}^2} + \frac{3(B + 2C\bar{x})}{(A + B\,\bar{x} + Cx^2)} \frac{\partial \bar{P}}{\partial \bar{x}} = \frac{B + 2C\bar{x}}{(A + B\,\bar{x} + Cx^2)^3} \tag{A12}$$

A standard finite centered-difference approximation is outlined by Crandall and is used to formulate the equation for programming. The approximations used for the partial derivative terms:

$$\frac{\partial^2 \bar{P}}{\partial \bar{x}^2} = \frac{\bar{P}_{i-1} - 2\bar{P}_i + \bar{P}_{i+1}}{\Delta \bar{x}^2} \tag{A13}$$

$$\frac{\partial \bar{P}}{\partial \bar{x}} = \frac{-\bar{P}_{i-1} + \bar{P}_{i+1}}{2\Delta \bar{x}} \tag{A14}$$

Substituting (A12) and (A13) into (A11) the following equation is obtained (A14):

$$\frac{\bar{P}_{i-1} - 2\bar{P}_i + \bar{P}_{i+1}}{\Delta\bar{x}^2} + \left[\frac{3(B + 2Ci\Delta\bar{x})}{A + Bi\Delta\bar{x} + C(i\Delta\bar{x})^2}\right]\left[\frac{-\bar{P}_{i-1} + \bar{P}_{i+1}}{2\Delta\bar{x}}\right] = \frac{B + 2Ci\Delta\bar{x}}{(A + Bi\Delta\bar{x} + C(i\Delta\bar{x})^2)^3}$$

Rearranging (A14), we obtain (A15):

$$\frac{\bar{P}_{i-1}}{\Delta\bar{x}^2}\left[\frac{3(B + 2Ci\Delta\bar{x})}{2\Delta\bar{x}(A + Bi\Delta\bar{x} + C(i\Delta\bar{x})^2)}\right] - \frac{2\bar{P}_i}{\Delta\bar{x}^2} + \frac{\bar{P}_{i+1}}{\Delta\bar{x}^2}\left[\frac{3(B + 2Ci\Delta\bar{x})}{2\Delta\bar{x}(A + Bi\Delta\bar{x} + C(i\Delta\bar{x})^2)}\right] = \frac{B + 2Ci\Delta\bar{x}}{(A + Bi\Delta\bar{x} + C(i\Delta\bar{x})^2)^3}$$

Equation (A15) is solved by computer program Pressure.c using standard matrix operations. The output of Pressure.c is a file which contains the non-dimensional pressure calculated at 200 points along the wetted width. When plotted, this file is a graphic representation of the pressure distribution under the ring. The area under this distribution is defined as the bearing number and is discussed at length in §2. The pressure distribution is also used to calculate shear stress and drag on the ring.

The C-language code begins on the following page.

```
/*****
*
*       Pressure.c
*
*       This program solves the a finite difference approximation to the
*       1-D Reynolds equation. The program uses a polynomial fit of the actual
*       film thickness data taken. (h = A + Bx + Cx^2). Prior to running this
*       program, the film trace must already be non-dimensionalized in
*       accordance with the specified parameters. This allows for input of
*       the coefficients A,B, and C to be non-dimensional.
*
*       As an aide to interpreting the code, the following is provided:
*       - a is the array for the diagonal elements for the coefficient matrix.
*       - b is the Array for the elements below the diagonal and c is the one *
        above.
*       - alpha and beta are dummy arrays used in solving the equation
*       - f is the constant array. Results are returned in array X.
*       - m is the order of the system.
*       - dx is the increment in the x direction. (xi=i*dx)
*
*       NOTE: all variables have been non-dimensionalized
*                       h is divided by the minimum thickness, ho
*                       x is divided by the wetted width, w
*                       P is divided by 6μUb and multiplied by ho^2
*
*                       The resulting equation is:
*
*                       ∂/∂x (h3*∂P/∂x) = ∂h/∂x                  Eqn (6)
*
******/

#define _ERRORCHECK_    /*  for standard error checking */

#include <stdio.h>
#include <math.h>

#define ndm (201)

FILE *fp1;
double          alpha[ndm], beta[ndm], y[ndm];
double          a[ndm], b[ndm], c[ndm], f[ndm], x[ndm];
double          dx, xi, A, B, C, sum;
double          P1, P2, mu, U, w,h;
short   m, i;

main()
{
        fp1 = fopen("aaPressure.txt", "w");

        printf("\nPlease input the crown land pressure (Pa)\n");
        scanf("%lf", &P1);
        printf("\nPlease input the second land pressure (Pa)\n");
        scanf("%lf", &P2);
        printf("\nPlease input the oil viscosity (Pa*s)\n");
```

```
        scanf("%lf", &mu);
        printf("\nPlease input the ring velocity (m/s)\n");
        scanf("%lf", &U);
        printf("\nPlease input the wetted ring width (m)\n");
        scanf("%lf", &w);
        printf("\%nPlease input the minimum film thickness (m)\n");
        scanf("%lf",&h);
        printf("\n\nh(x) = A + Bx + Cx^2\n");
        printf("\nPlease input A\n");
        scanf("%lf", &A);
        printf("\nPlease input B\n");
        scanf("%lf", &B);
        printf("\nPlease input C\n");
        scanf("%lf", &C);

        m = 200;
        dx = 1.0/m;

        for (i=1; i<=(m-1); i++)
        {
                xi=i*dx;
                b[i] = 1.0-(3.0*(B+2.*C*xi)*dx)/(2.0*(A+B*xi+C*pow(xi,2)));    /*
Pi-1 */
                a[i] = -2.0;
        /*Pi*/
                c[i] = 1.0+(3.0*(B+2.*C*xi)*dx)/(2.0*(A+B*xi+C*pow(xi,2))); /*
Pi+1 */
                f[i] = ((B+2.*C*xi)*pow(dx,2))/(pow(A+B*xi+C*pow(xi,2),3));
        }

        a[0] = 1.0;                             /* Initial conditions are that P1 = Pcl */
        a[m] = 1.0;                             /* and P2 = Psl */
        b[0] = 0.0;
        b[m] = 0.0;
        c[0] = 0.0;
        c[m] = 0.0;
        f[0] = P1*pow(h,2)/(6*mu*U*w);                  /*crown land pressure */

        f[m] = P2*pow(h,2)/(6*mu*U*w);                  /*2nd land pressure */


        alpha[0] = a[0];
        for (i=1; i<=m; i++)
        {
                beta[i] = b[i]/alpha[i-1];
                alpha[i] = a[i] - beta[i]*c[i-1];
        }
        y[0] = f[0];
        for (i=1; i<=m; i++)
        {
                y[i] = f[i] - beta[i]*y[i-1];
        }
        x[m] = y[m]/alpha[m];
        for (i=m-1; i>=0; i--)
```

```
        {
                x[i] = (y[i] - c[i]*x[i+1])/alpha[i];
        }

        for (i=0; i<=m; i++) sum = sum + x[i];
        sum = (sum-.5*x[0]-.5*x[m])*dx;     /*        trapezoidal integration */

        fprintf(fp1, "%e\t%e\tW*       = %f\n", 0.0*dx, x[0], sum);
        fprintf(fp1, "%e\t%e\tU(m/s)   = %f\n", 1.0*dx, x[1], U);
        fprintf(fp1, "%e\t%e\tmu(Pa*s) = %f\n", 2.0*dx, x[2], mu);
        fprintf(fp1, "%e\t%e\tPcrown   = %f\n", 3.0*dx, x[3], P1);
        fprintf(fp1, "%e\t%e\tP2ndland = %f\n", 4.0*dx, x[4], P2);
        fprintf(fp1, "%e\t%e\tw(m)     = %f\n", 5.0*dx, x[5], w);
        fprintf(fp1, "%e\t%e\tA        = %f\n", 6.0*dx, x[7], A);
        fprintf(fp1, "%e\t%e\tB        = %f\n", 7.0*dx, x[8], B);
        fprintf(fp1, "%e\t%e\tC        = %f\n", 8.0*dx, x[9], C);

        for (i=9; i<=m; i++) fprintf(fp1, "%e\t%e\n", i*dx, x[i]);
        for (i=0; i<=m; i++) printf("%e\t%e\n", i*dx, x[i]);

        printf("W* = %lf\n", sum);              /*        sum represents the non dim.
lift/length */

        fclose(fp1);
}
```

APPENDIX B - Exhaust Stroke Spreadsheet

	A	B	C	D	E	F	G	H
1	#201 Cummins 15W40 Motored 1000 rpm							
2	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
3	Exh-2	0.242354	10.948	0.1154	0.20084	11.94	0.126954	0.992
4	Exh-4	0.18071	10.907	0.13921	0.20512	11.915	0.0415	1.008
5	Exh-6	0.19028	10.909	0.11948	0.19028	11.883	0.0708	0.974
6	Exh-8	0.19632	10.984	0.13285	0.2183	11.915	0.06347	0.931
7	Exh-10	0.19712	10.948	0.14341	0.20689	11.883	0.05371	0.935
8	Exh-12	0.19364	10.888	0.13993	0.19852	11.876	0.05371	0.988
9	Exh-14	0.17981	10.948	0.12855	0.21155	11.845	0.05126	0.897
10								
11	#202 Cummins 15W40 Motored 1500 rpm							
12	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
13	Exh-2	0.13536	11.31	0.10118	0.11583	12.003	0.03418	0.693
14	Exh-8	0.16418	11.281	0.10732	0.11709	12.03	0.05686	0.749
15	Exh-10	0.13466	11.31	0.10048	0.15175	12.003	0.03418	0.693
16	Exh-12	0.12661	11.281	0.089992	0.13638	12.005	0.036618	0.724
17	Exh-14	0.12577	11.281	0.091587	0.12333	12.03	0.034183	0.749
18	Exh-20	0.11503	11.338	0.088179	0.11992	12.057	0.026851	0.719
19	Exh-22	0.1655	11.281	0.11424	0.1533	12.087	0.05126	0.806
20								
21	#203 Cummins 15W40 Motored 2000 rpm							
22	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
23	Exh-1	0.14003	11.222	0.10585	0.15223	11.876	0.03418	0.654
24	Exh-3	0.13075	11.147	0.10389	0.17225	11.915	0.02686	0.768
25	Exh-5	0.13667	11.147	0.095164	0.17573	11.927	0.041506	0.78
26	Exh-9	0.14663	11.147	0.095358	0.17348	11.89	0.051272	0.743
27	Exh-13	0.13952	11.147	0.11511	0.14684	11.853	0.02441	0.706
28	Exh-15	0.13382	11.036	0.084998	0.15335	11.89	0.048822	0.854
29	Exh-19	0.15059	10.889	0.10909	0.14327	11.63	0.0415	0.741
30	Exh-21	0.13802	10.961	0.098959	0.11849	11.667	0.039061	0.706
31	Exh-23	0.21336	10.887	0.15506	0.18924	11.89	0.0583	1.003
32	Exh-25	0.1504	11.087	0.094246	0.13331	11.816	0.056154	0.729
33	Exh-27	0.1422	11.147	0.11779	0.14709	11.89	0.02441	0.743
34								
35	#204 Cummins 15W40 Motored 2500 rpm							
36	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
37	Exh-2	0.11457	11.301	0.092603	0.15608	12.015	0.021967	0.714
38	Exh-4	0.11571	11.19	0.083973	0.14989	12.015	0.031737	0.825
39	Exh-6	0.11513	11.301	0.090717	0.14443	12.015	0.024413	0.714
40	Exh-10	0.13345	11.211	0.099274	0.17496	12.015	0.034176	0.804
41	Exh-12	0.1234	11.239	0.098984	0.11363	11.977	0.024416	0.738
42	Exh-14	0.11167	11.142	0.09726	0.11656	11.842	0.01441	0.7
43	Exh-16	0.13623	11.287	0.11914	0.11945	11.967	0.01709	0.68
44	Exh-22	0.10718	11.239	0.087647	0.16089	12.067	0.019533	0.828
45	Exh-24	0.11646	11.336	0.10425	0.1482	12.015	0.01221	0.679
46	Exh-28	0.113	11.336	0.091031	0.14718	12.0115	0.021969	0.6755
47	Exh-30	0.14	11.287	0.12291	0.15709	11.977	0.01709	0.69
48	Exh-34	0.11893	11.239	0.079863	0.10428	11.932	0.039067	0.693
49								
50								
51	#251 Havoline SAE30 Motored 1000 rpm							
52	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
53	Exh-1	0.17433	10.645	0.066907	0.07179	11.697	0.107423	1.052
54	Exh-3	0.25487	10.608	0.093738	0.11327	11.82	0.161132	1.212
55	Exh-5	0.21506	10.683	0.1052	0.16867	11.783	0.10986	1.1
56	Exh-7	0.21946	10.602	0.077857	0.1096	11.774	0.141603	1.172
57	Exh-9	0.18296	10.602	0.077978	0.11216	11.832	0.104982	1.23
58	Exh-11	0.2517	10.608	0.085689	0.13452	11.812	0.166011	1.204
59	Exh-13	0.22301	10.608	0.074086	0.096059	11.802	0.148924	1.194
60	Exh-15	0.23208	10.608	0.073385	0.092916	11.774	0.158695	1.166
61								
62	#252 Havoline SAE30 Motored 1500 rpm							
63	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
64	Exh-3	0.16239	10.727	0.072056	0.091587	11.8252	0.090334	1.0982
65	Exh-7	0.15772	10.582	0.060066	0.08448	11.558	0.097654	0.976
66	Exh-9	0.15149	10.758	0.063595	0.095334	11.736	0.087895	0.978
67	Exh-11	0.16952	10.814	0.091394	0.10604	11.764	0.078126	0.95
68	Exh-13	0.17015	10.786	0.072491	0.11399	11.778	0.097659	0.992
69	Exh-15	0.15591	10.727	0.086226	0.10952	11.822	0.069684	1.095
70	Exh-17	0.19408	10.785	0.072007	0.084214	11.793	0.122073	1.008
71	Exh-19	0.1619	10.796	0.071572	0.093545	11.707	0.090328	0.911
72	Exh-21	0.16623	10.525	0.066133	0.071016	11.793	0.100097	1.268
73								

	A	B	C	D	E	F	G	H
74	#253 Havoline SAE30 Motored 2000 rpm							
75	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
78	Exh-1	0.13742	10.655	0.078824	0.08859	11.857	0.058596	1.202
77	Exh-7	0.13217	10.739	0.095551	0.1102	11.646	0.036619	0.907
78	Exh-9	0.14747	10.774	0.098645	0.10597	11.597	0.048825	0.823
79	Exh-13	0.15376	10.664	0.092723	0.11225	11.709	0.061037	1.045
80	Exh-17	0.12922	10.776	0.099926	0.11457	11.606	0.029294	0.83
81	Exh-21	0.12543	10.701	0.0766	0.081483	11.646	0.04883	0.945
82	Exh-25	0.15941	10.739	0.135	0.15209	11.527	0.02441	0.788
83	Exh-27	0.11484	10.739	0.083102	0.087985	11.671	0.031738	0.932
84								
85	#301 MOBIL 1 MOTORED 1000 RPM							
88	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
87	Exh-1	0.24849	10.673	0.082474	0.11177	11.562	0.166016	0.889
88	Exh-3	0.25151	10.717	0.10014	0.14182	11.83	0.15137	1.113
89	Exh-5	0.25168	10.698	0.09543	0.14182	11.83	0.15625	1.132
90	Exh-7	0.2665	10.698	0.10537	0.13466	11.849	0.16113	1.151
91	Exh-9	0.21982	10.698	0.10508	0.15146	11.864	0.11474	1.166
92	Exh-11	0.25615	10.71	0.10967	0.14141	11.827	0.14648	1.117
93	Exh-13	0.24588	10.729	0.099395	0.21902	11.864	0.146485	1.135
94	Exh-15	0.186	10.737	0.10788	0.19089	11.83	0.07812	1.093
95								
98	#302 Mobil 1 Motored 1500 rpm							
97	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
98	Exh-1	0.22146	10.871	0.12381	0.14822	11.878	0.09765	1.007
99	Exh-3	0.21665	10.525	0.1167	0.18736	11.673	0.09995	1.148
100	Exh-5	0.24757	10.641	0.13527	0.16456	11.734	0.1123	1.093
101	Exh-7	0.21383	10.612	0.11861	0.16988	11.762	0.09522	1.15
102	Exh-9	0.22746	10.554	0.10783	0.14201	11.763	0.11963	1.209
103	Exh-11	0.22349	10.612	0.14781	0.16281	11.762	0.07568	1.15
104	Exh-13	0.24588	10.554	0.11648	0.1531	11.734	0.1294	1.18
105	Exh-17	0.21165	10.641	0.10911	0.17015	11.792	0.10254	1.151
106	Exh-19	0.2424	10.633	0.14718	0.1716	11.677	0.09522	1.044
107								
108	#303 Mobil 1 Motored 2000 rpm							
109	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
110	Exh-1	0.20703	10.586	0.10694	0.15332	11.697	0.10009	1.111
111	Exh-3	0.20203	10.507	0.10926	0.15076	11.623	0.09277	1.116
112	Exh-5	0.22422	10.579	0.1461	0.17051	11.734	0.07812	1.155
113	Exh-7	0.18603	10.43	0.1079	0.14696	11.623	0.07813	1.193
114	Exh-9	0.23232	10.505	0.098041	0.18105	11.655	0.134279	1.15
115	Exh-11	0.20292	10.467	0.11992	0.14677	11.66	0.083	1.193
118	Exh-13	0.19217	10.542	0.11404	0.14822	11.66	0.07813	1.118
117	Exh-17	0.18902	10.43	0.10358	0.15729	11.655	0.08544	1.225
118	Exh-19	0.19224	10.547	0.11656	0.15328	11.66	0.07568	1.113
119	Exh-21	0.1825	10.579	0.09705	0.14344	11.66	0.08545	1.081
120	Exh-23	0.19898	10.547	0.11598	0.15748	11.695	0.083	1.148
121	Exh-25	0.1957	10.507	0.13222	0.1664	11.697	0.06348	1.19
122	Exh-27	0.20338	10.547	0.13014	0.16676	11.66	0.07324	1.113
123								
124	#352 PENNZOIL 15W40 MOTORED 1500 RPM							
125	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
128	Exh-1	0.17892	10.419	0.13986	0.1716	11.417	0.03906	0.998
127	Exh-3	0.25557	10.473	0.16524	0.19209	11.377	0.09033	0.904
128	Exh-5	0.19183	10.386	0.12347	0.15765	11.388	0.06836	1.002
129	Exh-7	0.22207	10.415	0.13662	0.19033	11.445	0.08545	1.03
130	Exh-11	0.19811	10.358	0.14196	0.19567	11.35	0.05615	0.992
131	Exh-13	0.19456	10.415	0.14085	0.17259	11.36	0.05371	0.945
132	Exh-15	0.22045	10.282	0.13256	0.22289	11.217	0.08789	0.935
133	Exh-17	0.21426	10.358	0.1459	0.17032	11.331	0.06836	0.973
134	Exh-19	0.18682	10.473	0.12335	0.15997	11.35	0.06347	0.877
135	Exh-21	0.1787	10.415	0.10546	0.12499	11.455	0.07324	1.04
136								
137	#353 PENNZOIL 15W40 MOTORED 2000 RPM							
138	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
139	Exh-1	0.15175	10.464	0.10781	0.15175	11.289	0.04394	0.825
140	Exh-3	0.15668	10.464	0.088324	0.14936	11.427	0.068356	0.963
141	Exh-5	0.14974	10.464	0.12289	0.14974	11.365	0.02685	0.901
142	Exh-9	0.14544	10.462	0.1137	0.16497	11.353	0.03174	0.891
143	Exh-11	0.15332	10.304	0.11078	0.14112	10.983	0.04254	0.679
144	Exh-13	0.15032	10.538	0.12591	0.16986	11.316	0.02441	0.778
145	Exh-15	0.16229	10.304	0.12567	0.13543	11.131	0.03662	0.827
146	Exh-17	0.1744	10.315	0.13534	0.14754	11.168	0.03906	0.853

	A	B	C	D	E	F	G	H
147	Exh-19	0.18064	10.353	0.12937	0.14402	11.131	0.05127	0.778
148	Exh-21	0.18267	10.353	0.11675	0.13872	11.094	0.06592	0.741
149	Exh-23	0.15912	10.304	0.1225	0.13959	11.094	0.03662	0.79
150	Exh-25	0.19067	10.241	0.14184	0.15161	11.092	0.04883	0.851
151	Exh-27	0.15509	10.501	0.12335	0.15509	11.316	0.03174	0.815
152								
153	#401 Pennzoil SAE30 Motored 1000 rpm							
154	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
155	Exh-1	0.21523	10.543	0.10292	0.16396	11.594	0.11231	1.051
156	Exh-3	0.2119	10.486	0.10377	0.18678	11.646	0.10813	1.16
157	Exh-5	0.19529	10.486	0.10007	0.16599	11.651	0.09522	1.165
158	Exh-7	0.19103	10.59	0.10802	0.16174	11.651	0.08301	1.061
159	Exh-9	0.20544	10.404	0.10046	0.15173	11.628	0.10498	1.224
160	Exh-11	0.21225	10.478	0.10483	0.16587	11.575	0.10742	1.097
161	Exh-13	0.20396	10.582	0.11607	0.16002	11.575	0.08789	0.993
162	Exh-15	0.22258	10.524	0.12492	0.14933	11.651	0.09766	1.127
163								
164	#402 Pennzoil SAE30 Motored 1500 rpm							
165	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
166	Exh-2	0.23771	10.361	0.1132	0.1254	11.566	0.12451	1.205
167	Exh-4	0.22869	10.361	0.12615	0.15057	11.535	0.10254	1.174
168	Exh-6	0.25506	10.361	0.11102	0.16229	11.48	0.14404	1.119
169	Exh-8	0.23701	10.41	0.13447	0.15888	11.566	0.10254	1.156
170	Exh-10	0.22659	10.419	0.12161	0.13626	11.508	0.10498	1.089
171	Exh-12	0.23121	10.448	0.12623	0.15552	11.562	0.10498	1.114
172	Exh-14	0.23623	10.361	0.12393	0.15323	11.453	0.1123	1.092
173	Exh-16	0.26062	10.361	0.12146	0.16053	11.535	0.13916	1.174
174	Exh-18	0.21745	10.332	0.11735	0.13689	11.48	0.1001	1.148
175	Exh-20	0.24249	10.355	0.11798	0.1424	11.566	0.12451	1.211
176	Exh-22	0.25057	10.438	0.13338	0.17733	11.508	0.11719	1.07
177								
178	#403 Pennzoil SAE30 Motored 2000 rpm							
179	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
180	Exh-2	0.22306	10.478	0.12785	0.14493	11.48	0.09521	1.002
181	Exh-4	0.2351	10.329	0.13012	0.13256	11.48	0.10498	1.151
182	Exh-6	0.21092	10.257	0.12304	0.14012	11.48	0.08788	1.223
183	Exh-8	0.2327	10.366	0.10819	0.11308	11.48	0.12451	1.114
184	Exh-10	0.21276	10.366	0.13708	0.15173	11.554	0.07568	1.188
185	Exh-12	0.24506	10.366	0.1059	0.15228	11.517	0.13916	1.151
186	Exh-14	0.24745	10.292	0.14491	0.15468	11.441	0.10254	1.149
187	Exh-18	0.19243	10.366	0.1314	0.16558	11.48	0.06103	1.114
188	Exh-22	0.2475	10.404	0.12787	0.15228	11.443	0.11963	1.039
189	Exh-24	0.21803	10.366	0.10573	0.13258	11.558	0.1123	1.192
190	Exh-26	0.23677	10.297	0.12934	0.15376	11.517	0.10743	1.22
191	Exh-28	0.25613	10.366	0.10476	0.13406	11.48	0.15137	1.114
192								
193	#404 Pennzoil SAE30 Motored 2500 rpm							
194	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
195	Exh-3	0.17068	10.579	0.12673	0.16335	11.48	0.04395	0.901
196	Exh-5	0.18617	10.534	0.13979	0.18373	11.49	0.04638	0.956
197	Exh-9	0.18982	10.443	0.13611	0.17762	11.383	0.05371	0.94
198	Exh-17	0.19173	10.443	0.16976	0.19173	11.528	0.02197	1.085
199	Exh-19	0.2182	10.558	0.16937	0.19135	11.57	0.04883	1.012
200	Exh-21	0.18941	10.412	0.11851	0.12838	11.625	0.0709	1.213
201	Exh-23	0.21665	10.461	0.16783	0.18247	11.48	0.04882	1.019
202	Exh-27	0.16079	10.558	0.13638	0.18275	11.48	0.02441	0.922

	I	J	K	L	M	N	O	P
1	#201 Cummins 15W40 Motored 1000 rpm							
2	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
3	Exh-2	32.7	3.882385321	3.529051988	220025	73	17.05520631	0.017055206
4	Exh-4	32.7	1.26911315	4.257186544	220025	73	17.05520631	0.017055206
5	Exh-6	32.7	2.165137615	3.65382263	220025	73	17.05520631	0.017055206
6	Exh-8	32.7	1.940978593	4.062691131	220025	73	17.05520631	0.017055206
7	Exh-10	32.7	1.642507645	4.385626911	220025	73	17.05520631	0.017055206
8	Exh-12	32.7	1.642507645	4.279204893	220025	73	17.05520631	0.017055206
9	Exh-14	32.7	1.567584098	3.931192661	220025	73	17.05520631	0.017055206
10								
11	#202 Cummins 15W40 Motored 1500 rpm							
12	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
13	Exh-2	32.7	1.045259939	3.094189602	220025	83.3	12.98359739	0.012983597
14	Exh-8	32.7	1.73883792	3.281957187	220025	83.3	12.98359739	0.012983597
15	Exh-10	32.7	1.045259939	3.072782875	220025	83.3	12.98359739	0.012983597
16	Exh-12	32.7	1.119816514	2.75204893	220025	83.3	12.98359739	0.012983597
17	Exh-14	32.7	1.045351682	2.800825688	220025	83.3	12.98359739	0.012983597
18	Exh-20	32.7	0.821131498	2.696605505	220025	83.3	12.98359739	0.012983597
19	Exh-22	32.7	1.567584098	3.493577982	220025	83.3	12.98359739	0.012983597
20								
21	#203 Cummins 15W40 Motored 2000 rpm							
22	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
23	Exh-1	32.7	1.045259939	3.237003058	220025	92.7	10.40957555	0.010409576
24	Exh-3	32.7	0.821406728	3.17706422	220025	92.7	10.40957555	0.010409576
25	Exh-5	32.7	1.269296636	2.910214067	220025	92.7	10.40957555	0.010409576
26	Exh-9	32.7	1.56795107	2.916146789	220025	92.7	10.40957555	0.010409576
27	Exh-13	32.7	0.74648318	3.520183486	220025	92.7	10.40957555	0.010409576
28	Exh-15	32.7	1.493027523	2.599327217	220025	92.7	10.40957555	0.010409576
29	Exh-19	32.7	1.26911315	3.336085627	220025	92.7	10.40957555	0.010409576
30	Exh-21	32.7	1.194525994	3.026269113	220025	92.7	10.40957555	0.010409576
31	Exh-23	32.7	1.782874618	4.741896024	220025	92.7	10.40957555	0.010409576
32	Exh-25	32.7	1.717247706	2.882140673	220025	92.7	10.40957555	0.010409576
33	Exh-27	32.7	0.74648318	3.602140673	220025	92.7	10.40957555	0.010409576
34								
35	#204 Cummins 15W40 Motored 2500 rpm							
36	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
37	Exh-2	32.7	0.6717737	2.831896024	220025	101.3	8.665777225	0.008665777
38	Exh-4	32.7	0.970550459	2.567981651	220025	101.3	8.665777225	0.008665777
39	Exh-6	32.7	0.746574924	2.774220183	220025	101.3	8.665777225	0.008665777
40	Exh-10	32.7	1.045137615	3.035902141	220025	101.3	8.665777225	0.008665777
41	Exh-12	32.7	0.746666667	3.027033639	220025	101.3	8.665777225	0.008665777
42	Exh-14	32.7	0.440672783	2.974311927	220025	101.3	8.665777225	0.008665777
43	Exh-16	32.7	0.522629969	3.643425076	220025	101.3	8.665777225	0.008665777
44	Exh-22	32.7	0.59733945	2.680336391	220025	101.3	8.665777225	0.008665777
45	Exh-24	32.7	0.373394495	3.188073394	220025	101.3	8.665777225	0.008665777
46	Exh-28	32.7	0.671834862	2.78382263	220025	101.3	8.665777225	0.008665777
47	Exh-30	32.7	0.522629969	3.758715596	220025	101.3	8.665777225	0.008665777
48	Exh-34	32.7	1.19470948	2.442293578	220025	101.3	8.665777225	0.008665777
49								
50								
51	#251 Havoline SAE30 Motored 1000 rpm							
52	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
53	Exh-1	35.6	3.0175	1.879410112	220025	73	17.10375498	0.017103755
54	Exh-3	35.6	4.526179775	2.633089888	220025	73	17.10375498	0.017103755
55	Exh-5	35.6	3.085955056	2.95505618	220025	73	17.10375498	0.017103755
56	Exh-7	35.6	3.97761236	2.186994382	220025	73	17.10375498	0.017103755
57	Exh-9	35.6	2.948932584	2.190393258	220025	73	17.10375498	0.017103755
58	Exh-11	35.6	4.663230337	2.406994382	220025	73	17.10375498	0.017103755
59	Exh-13	35.6	4.183258427	2.081067416	220025	73	17.10375498	0.017103755
60	Exh-15	35.6	4.457724719	2.061376404	220025	73	17.10375498	0.017103755
61								
62	#252 Havoline SAE30 Motored 1500 rpm							
63	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
64	Exh-3	35.6	2.53747191	2.024044944	220025	83.3	12.5655416	0.012565542
65	Exh-7	35.6	2.743089888	1.687247191	220025	83.3	12.5655416	0.012565542
66	Exh-9	35.6	2.468960674	1.786376404	220025	83.3	12.5655416	0.012565542
67	Exh-11	35.6	2.194550562	2.567247191	220025	83.3	12.5655416	0.012565542
68	Exh-13	35.6	2.743230337	2.036264045	220025	83.3	12.5655416	0.012565542
69	Exh-15	35.6	1.95741573	2.422078652	220025	83.3	12.5655416	0.012565542
70	Exh-17	35.6	3.429016854	2.022668539	220025	83.3	12.5655416	0.012565542
71	Exh-19	35.6	2.537303371	2.010449438	220025	83.3	12.5655416	0.012565542
72	Exh-21	35.6	2.811713483	1.857668539	220025	83.3	12.5655416	0.012565542
73								

	I	J	K	L	M	N	O	P
74	#253 Havoline SAE30 Motored 2000 rpm							
75	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
76	Exh-1	35.6	1.645955056	2.214157303	220025	92.7	9.788249549	0.00978825
77	Exh-7	35.6	1.028623596	2.684016854	220025	92.7	9.788249549	0.00978825
78	Exh-9	35.6	1.371488764	2.770926966	220025	92.7	9.788249549	0.00978825
79	Exh-13	35.6	1.714522472	2.604578652	220025	92.7	9.788249549	0.00978825
80	Exh-17	35.6	0.822865169	2.806910112	220025	92.7	9.788249549	0.00978825
81	Exh-21	35.6	1.371629213	2.151685393	220025	92.7	9.788249549	0.00978825
82	Exh-25	35.6	0.685674157	3.792134831	220025	92.7	9.788249549	0.00978825
83	Exh-27	35.6	0.891516854	2.334325843	220025	92.7	9.788249549	0.00978825
84								
85	#301 MOBIL 1 MOTORED 1000 RPM							
86	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
87	Exh-1	33.8	4.911715976	2.440059172	220025	73	20.98534438	0.020985344
88	Exh-3	33.8	4.478402367	2.962721893	220025	73	20.98534438	0.020985344
89	Exh-5	33.8	4.622781065	2.823372781	220025	73	20.98534438	0.020985344
90	Exh-7	33.8	4.767159763	3.117455621	220025	73	20.98534438	0.020985344
91	Exh-9	33.8	3.394674556	3.10887574	220025	73	20.98534438	0.020985344
92	Exh-11	33.8	4.333727811	3.244674556	220025	73	20.98534438	0.020985344
93	Exh-13	33.8	4.33387574	2.940680473	220025	73	20.98534438	0.020985344
94	Exh-15	33.8	2.311242604	3.191715976	220025	73	20.98534438	0.020985344
95								
96	#302 Mobil 1 Motored 1500 rpm							
97	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
98	Exh-1	33.8	2.889053254	3.663017751	220025	83.3	15.88381858	0.015883819
99	Exh-3	33.8	2.957100592	3.452662722	220025	83.3	15.88381858	0.015883819
100	Exh-5	33.8	3.322485207	4.002071006	220025	83.3	15.88381858	0.015883819
101	Exh-7	33.8	2.817159763	3.509171598	220025	83.3	15.88381858	0.015883819
102	Exh-9	33.8	3.539349112	3.190236686	220025	83.3	15.88381858	0.015883819
103	Exh-11	33.8	2.239053254	4.373076923	220025	83.3	15.88381858	0.015883819
104	Exh-13	33.8	3.828402367	3.446153846	220025	83.3	15.88381858	0.015883819
105	Exh-17	33.8	3.033727811	3.228106509	220025	83.3	15.88381858	0.015883819
106	Exh-19	33.8	2.817159763	4.35443787	220025	83.3	15.88381858	0.015883819
107								
108	#303 Mobil 1 Motored 2000 rpm							
109	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
110	Exh-1	33.8	2.961242604	3.163905325	220025	92.7	12.67559472	0.012675595
111	Exh-3	33.8	2.744674556	3.232544379	220025	92.7	12.67559472	0.012675595
112	Exh-5	33.8	2.311242604	4.322485207	220025	92.7	12.67559472	0.012675595
113	Exh-7	33.8	2.311538462	3.192307692	220025	92.7	12.67559472	0.012675595
114	Exh-9	33.8	3.972751479	2.900621302	220025	92.7	12.67559472	0.012675595
115	Exh-11	33.8	2.455621302	3.547928994	220025	92.7	12.67559472	0.012675595
116	Exh-13	33.8	2.311538462	3.373964497	220025	92.7	12.67559472	0.012675595
117	Exh-17	33.8	2.527810651	3.064497041	220025	92.7	12.67559472	0.012675595
118	Exh-19	33.8	2.239053254	3.44852071	220025	92.7	12.67559472	0.012675595
119	Exh-21	33.8	2.528106509	2.871301775	220025	92.7	12.67559472	0.012675595
120	Exh-23	33.8	2.455621302	3.431360947	220025	92.7	12.67559472	0.012675595
121	Exh-25	33.8	1.878106509	3.91183432	220025	92.7	12.67559472	0.012675595
122	Exh-27	33.8	2.166863905	3.850295858	220025	92.7	12.67559472	0.012675595
123								
124	#352 PENNZOIL 15W40 MOTORED 1500 RPM							
125	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
126	Exh-1	31.9	1.224451411	4.384326019	220025	73	16.78137129	0.016781371
127	Exh-3	31.9	2.831661442	5.179937304	220025	73	16.78137129	0.016781371
128	Exh-5	31.9	2.142946708	3.870532915	220025	73	16.78137129	0.016781371
129	Exh-7	31.9	2.678683386	4.282758621	220025	73	16.78137129	0.016781371
130	Exh-11	31.9	1.760188088	4.45015674	220025	73	16.78137129	0.016781371
131	Exh-13	31.9	1.68369906	4.415360502	220025	73	16.78137129	0.016781371
132	Exh-15	31.9	2.755172414	4.155485893	220025	73	16.78137129	0.016781371
133	Exh-17	31.9	2.142946708	4.573667712	220025	73	16.78137129	0.016781371
134	Exh-19	31.9	1.989655172	3.86677116	220025	73	16.78137129	0.016781371
135	Exh-21	31.9	2.295924765	3.305956113	220025	73	16.78137129	0.016781371
136								
137	#352 PENNZOIL 15W40 MOTORED 1500 RPM							
138	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
139	Exh-1	31.9	1.377429467	3.379623824	220025	83.3	12.86091126	0.012860911
140	Exh-3	31.9	2.142821317	2.768777429	220025	83.3	12.86091126	0.012860911
141	Exh-5	31.9	0.84169279	3.852351097	220025	83.3	12.86091126	0.012860911
142	Exh-9	31.9	0.994984326	3.564263323	220025	83.3	12.86091126	0.012860911
143	Exh-11	31.9	1.33354232	3.472727273	220025	83.3	12.86091126	0.012860911
144	Exh-13	31.9	0.765203762	3.947021944	220025	83.3	12.86091126	0.012860911
145	Exh-15	31.9	1.147962382	3.939498433	220025	83.3	12.86091126	0.012860911
146	Exh-17	31.9	1.224451411	4.242633229	220025	83.3	12.86091126	0.012860911

	I	J	K	L	M	N	O	P
147	Exh-19	31.9	1.607210031	4.055485893	220025	83.3	12.86091126	0.012860911
148	Exh-21	31.9	2.06645768	3.659874608	220025	83.3	12.86091126	0.012860911
149	Exh-23	31.9	1.147962382	3.840125392	220025	83.3	12.86091126	0.012860911
150	Exh-25	31.9	1.530721003	4.446394984	220025	83.3	12.86091126	0.012860911
151	Exh-27	31.9	0.994984326	3.86677116	220025	83.3	12.86091126	0.012860911
152								
153	#401 Pennzoil SAE30 Motored 1000 rpm							
154	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
155	Exh-1	39.1	2.872378517	2.632225064	220025	73	17.19084034	0.01719084
156	Exh-3	39.1	2.765473146	2.653964194	220025	73	17.19084034	0.01719084
157	Exh-5	39.1	2.435294118	2.559335038	220025	73	17.19084034	0.01719084
158	Exh-7	39.1	2.123017903	2.762659847	220025	73	17.19084034	0.01719084
159	Exh-9	39.1	2.684910486	2.569309463	220025	73	17.19084034	0.01719084
160	Exh-11	39.1	2.747314578	2.681074169	220025	73	17.19084034	0.01719084
161	Exh-13	39.1	2.247826087	2.968542199	220025	73	17.19084034	0.01719084
162	Exh-15	39.1	2.49769821	3.19488491	220025	73	17.19084034	0.01719084
163								
164	#402 Pennzoil SAE30 Motored 1500 rpm							
165	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
166	Exh-2	39.1	3.184398977	2.895140665	220025	83.3	12.79394332	0.012793943
167	Exh-4	39.1	2.622506394	3.226342711	220025	83.3	12.79394332	0.012793943
168	Exh-6	39.1	3.683887468	2.839386189	220025	83.3	12.79394332	0.012793943
169	Exh-8	39.1	2.622506394	3.439130435	220025	83.3	12.79394332	0.012793943
170	Exh-10	39.1	2.684910486	3.110230179	220025	83.3	12.79394332	0.012793943
171	Exh-12	39.1	2.684910486	3.228388747	220025	83.3	12.79394332	0.012793943
172	Exh-14	39.1	2.872122762	3.169565217	220025	83.3	12.79394332	0.012793943
173	Exh-16	39.1	3.559079284	3.106393862	220025	83.3	12.79394332	0.012793943
174	Exh-18	39.1	2.560102302	3.001278772	220025	83.3	12.79394332	0.012793943
175	Exh-20	39.1	3.184398977	3.017391304	220025	83.3	12.79394332	0.012793943
176	Exh-22	39.1	2.997186701	3.411253197	220025	83.3	12.79394332	0.012793943
177								
178	#403 Pennzoil SAE30 Motored 2000 rpm							
179	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
180	Exh-2	39.1	2.435038363	3.269820972	220025	92.7	10.07114496	0.010071145
181	Exh-4	39.1	2.684910486	3.327877238	220025	92.7	10.07114496	0.010071145
182	Exh-6	39.1	2.247570332	3.146803069	220025	92.7	10.07114496	0.010071145
183	Exh-8	39.1	3.184398977	2.767007673	220025	92.7	10.07114496	0.010071145
184	Exh-10	39.1	1.935549872	3.505882353	220025	92.7	10.07114496	0.010071145
185	Exh-12	39.1	3.559079284	2.708439898	220025	92.7	10.07114496	0.010071145
186	Exh-14	39.1	2.622506394	3.706138107	220025	92.7	10.07114496	0.010071145
187	Exh-18	39.1	1.560869565	3.360613811	220025	92.7	10.07114496	0.010071145
188	Exh-22	39.1	3.059590793	3.270332481	220025	92.7	10.07114496	0.010071145
189	Exh-24	39.1	2.872122762	2.704092072	220025	92.7	10.07114496	0.010071145
190	Exh-26	39.1	2.747570332	3.307928389	220025	92.7	10.07114496	0.010071145
191	Exh-28	39.1	3.871355499	2.679283887	220025	92.7	10.07114496	0.010071145
192								
193	#404 Pennzoil SAE30 Motored 2500 rpm							
194	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
195	Exh-3	39.1	1.124040921	3.241176471	220025	101.3	8.2574414	0.009760465
196	Exh-5	39.1	1.186189258	3.575191816	220025	101.3	8.2574414	0.009760465
197	Exh-9	39.1	1.373657289	3.481074169	220025	101.3	8.2574414	0.009760465
198	Exh-17	39.1	0.561892583	4.34168798	220025	101.3	8.2574414	0.009760465
199	Exh-19	39.1	1.248849105	4.331713555	220025	101.3	8.2574414	0.009760465
200	Exh-21	39.1	1.813299233	3.030946292	220025	101.3	8.2574414	0.009760465
201	Exh-23	39.1	1.24859335	4.292327366	220025	101.3	8.2574414	0.009760465
202	Exh-27	39.1	0.624296675	3.48797954	220025	101.3	8.2574414	0.009760465

	Q	R	S	T	U	V	W	X
1	#201 Cummins 15W40 Motored 1000 rpm							
2	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
3	Exh-2	863.838	3.81	0.00192	1083.527791	559.8226922	79014.57928	0.00178628
4	Exh-4	863.838	3.81	0.00192	1083.527791	568.8520905	56062.91853	0.001757926
5	Exh-6	863.838	3.81	0.00192	1083.527791	549.6646192	71059.63808	0.001819291
6	Exh-8	863.838	3.81	0.00192	1083.527791	525.3981114	52513.59492	0.001903319
7	Exh-10	863.838	3.81	0.00192	1083.527791	527.6554609	45452.71769	0.001895176
8	Exh-12	863.838	3.81	0.00192	1083.527791	557.5653427	53307.42766	0.001793512
9	Exh-14	863.838	3.81	0.00192	1083.527791	506.2106401	52063.84394	0.001975462
10								
11	#202 Cummins 15W40 Motored 1500 rpm							
12	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
13	Exh-2	857.349	5.715	0.00192	948.878777	342.4859336	50161.74365	0.002919828
14	Exh-8	857.349	5.715	0.00192	948.878777	370.1615646	52083.21837	0.002701523
15	Exh-10	857.349	5.715	0.00192	948.878777	342.4859336	50863.08779	0.002919828
16	Exh-12	857.349	5.715	0.00192	948.878777	357.8063722	69209.35952	0.002794808
17	Exh-14	857.349	5.715	0.00192	948.878777	370.1615646	71514.06642	0.002701523
18	Exh-20	857.349	5.715	0.00192	948.878777	355.3353337	71092.36261	0.002814243
19	Exh-22	857.349	5.715	0.00192	948.878777	398.3314033	53226.65819	0.002510472
20								
21	#203 Cummins 15W40 Motored 2000 rpm							
22	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
23	Exh-1	851.427	7.62	0.00192	887.634176	302.3503912	40819.65006	0.003307421
24	Exh-3	851.427	7.62	0.00192	887.634176	355.0536704	58434.65077	0.002816476
25	Exh-5	851.427	7.62	0.00192	887.634176	360.601384	71835.53558	0.002773145
26	Exh-9	851.427	7.62	0.00192	887.634176	343.4959337	64917.06333	0.002911243
27	Exh-13	851.427	7.62	0.00192	887.634176	326.3904835	40223.40202	0.003063815
28	Exh-15	851.427	7.62	0.00192	887.634176	394.8122845	107942.8382	0.002532849
29	Exh-19	851.427	7.62	0.00192	887.634176	342.5713148	49335.78443	0.0029191
30	Exh-21	851.427	7.62	0.00192	887.634176	326.3904835	54424.4829	0.003063815
31	Exh-23	851.427	7.62	0.00192	887.634176	463.6963951	44740.18876	0.002156584
32	Exh-25	851.427	7.62	0.00192	887.634176	337.0236012	63977.12327	0.002967151
33	Exh-27	851.427	7.62	0.00192	887.634176	343.4959337	42545.76033	0.002911243
34								
35	#204 Cummins 15W40 Motored 2500 rpm							
36	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
37	Exh-2	846.009	9.525	0.00192	853.0009275	317.2097199	63568.47837	0.003152489
38	Exh-4	846.009	9.525	0.00192	853.0009275	366.5238361	103210.5434	0.002728336
39	Exh-6	846.009	9.525	0.00192	853.0009275	317.2097199	66239.12233	0.003152489
40	Exh-10	846.009	9.525	0.00192	853.0009275	357.1941384	70135.28413	0.002799598
41	Exh-12	846.009	9.525	0.00192	853.0009275	327.8722315	59439.92176	0.003049969
42	Exh-14	846.009	9.525	0.00192	853.0009275	310.9899215	55388.94012	0.003215538
43	Exh-16	846.009	9.525	0.00192	853.0009275	302.1044952	34833.58225	0.003310113
44	Exh-22	846.009	9.525	0.00192	853.0009275	367.85665	95429.37242	0.00271845
45	Exh-24	846.009	9.525	0.00192	853.0009275	301.6602239	45361.032	0.003314988
46	Exh-28	846.009	9.525	0.00192	853.0009275	300.1052742	58879.97065	0.003332164
47	Exh-30	846.009	9.525	0.00192	853.0009275	306.5472083	33699.17349	0.00326214
48	Exh-34	846.009	9.525	0.00192	853.0009275	307.8800223	80513.87597	0.003248018
49								
50								
51	#251 Havoline SAE30 Motored 1000 rpm							
52	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
53	Exh-1	863.838	3.81	0.00192	1080.452219	591.9977784	313320.1754	0.001689196
54	Exh-3	863.838	3.81	0.00192	1080.452219	682.0354633	211872.1479	0.001466199
55	Exh-5	863.838	3.81	0.00192	1080.452219	619.0090839	138565.1086	0.001615485
56	Exh-7	863.838	3.81	0.00192	1080.452219	659.5260421	287183.7674	0.00151624
57	Exh-9	863.838	3.81	0.00192	1080.452219	692.1647029	315330.5401	0.001444743
58	Exh-11	863.838	3.81	0.00192	1080.452219	677.5335791	250208.9386	0.001475942
59	Exh-13	863.838	3.81	0.00192	1080.452219	671.9062238	329182.2088	0.001488303
60	Exh-15	863.838	3.81	0.00192	1080.452219	656.1496289	319950.2837	0.001524043
61								
62	#252 Havoline SAE30 Motored 1500 rpm							
63	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
64	Exh-3	857.349	5.715	0.00192	980.4479912	560.795825	294389.6758	0.00178318
65	Exh-7	857.349	5.715	0.00192	980.4479912	498.3943955	334612.5363	0.002006443
66	Exh-9	857.349	5.715	0.00192	980.4479912	499.4156955	299731.0687	0.00200234
67	Exh-11	857.349	5.715	0.00192	980.4479912	485.1174956	136934.1707	0.002061356
68	Exh-13	857.349	5.715	0.00192	980.4479912	506.5647954	237331.3768	0.001974081
69	Exh-15	857.349	5.715	0.00192	980.4479912	559.161745	204386.2873	0.001788391
70	Exh-17	857.349	5.715	0.00192	980.4479912	514.7351954	248354.2665	0.001942747
71	Exh-19	857.349	5.715	0.00192	980.4479912	465.2021458	205329.0715	0.002149603
72	Exh-21	857.349	5.715	0.00192	980.4479912	647.5041942	465910.0245	0.001544392
73								

	Q	R	S	T	U	V	W	X
74	#253 Havoline SAE30 Motored 2000 rpm							
75	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
76	Exh-1	851.427	7.62	0.00192	943.978284	590.9697382	294708.0452	0.001692134
77	Exh-7	851.427	7.62	0.00192	943.978284	445.9314081	114194.2133	0.002242497
78	Exh-9	851.427	7.62	0.00192	943.978284	404.6323582	88216.43682	0.002471379
79	Exh-13	851.427	7.62	0.00192	943.978284	513.7798473	160974.7013	0.001946359
80	Exh-17	851.427	7.62	0.00192	943.978284	408.0739457	87437.79045	0.002450536
81	Exh-21	851.427	7.62	0.00192	943.978284	464.6143117	192888.3836	0.002152323
82	Exh-25	851.427	7.62	0.00192	943.978284	387.4244207	43180.2243	0.002581149
83	Exh-27	851.427	7.62	0.00192	943.978284	458.222792	159407.5433	0.002182345
84								
85	#301 MOBIL 1 MOTORED 1000 RPM							
86	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
87	Exh-1	863.838	3.81	0.00192	880.6045635	407.7382588	132740.3033	0.002452554
88	Exh-3	863.838	3.81	0.00192	880.6045635	510.4754579	141126.4948	0.001958958
89	Exh-5	863.838	3.81	0.00192	880.6045635	519.1897739	160752.008	0.001926078
90	Exh-7	863.838	3.81	0.00192	880.6045635	527.9040899	136317.0213	0.001894283
91	Exh-9	863.838	3.81	0.00192	880.6045635	534.783813	140666.4001	0.001869914
92	Exh-11	863.838	3.81	0.00192	880.6045635	512.3100507	118512.4728	0.001951943
93	Exh-13	863.838	3.81	0.00192	880.6045635	520.5657185	148969.0498	0.001920987
94	Exh-15	863.838	3.81	0.00192	880.6045635	501.3024937	117271.3295	0.001994804
95								
96	#302 Mobil 1 Motored 1500 rpm							
97	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
98	Exh-1	857.349	5.715	0.00192	775.6233147	406.7982698	75575.47657	0.002458221
99	Exh-3	857.349	5.715	0.00192	775.6233147	463.7581069	110554.2556	0.002156297
100	Exh-5	857.349	5.715	0.00192	775.6233147	441.5397307	74588.30609	0.002264802
101	Exh-7	857.349	5.715	0.00192	775.6233147	464.5660479	107395.5952	0.002152546
102	Exh-9	857.349	5.715	0.00192	775.6233147	488.400306	143617.3113	0.002047501
103	Exh-11	857.349	5.715	0.00192	775.6233147	464.5660479	69154.65949	0.002152546
104	Exh-13	857.349	5.715	0.00192	775.6233147	476.6851622	117245.0973	0.002097821
105	Exh-17	857.349	5.715	0.00192	775.6233147	464.9700184	127132.0167	0.002150676
106	Exh-19	857.349	5.715	0.00192	775.6233147	421.7451774	57482.65257	0.0023711
107								
108	#303 Mobil 1 Motored 2000 rpm							
109	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
110	Exh-1	851.427	7.62	0.00192	728.9515968	421.8048042	123305.1338	0.002370765
111	Exh-3	851.427	7.62	0.00192	728.9515968	423.7031156	119189.8841	0.002360143
112	Exh-5	851.427	7.62	0.00192	728.9515968	438.5099449	71399.79044	0.00228045
113	Exh-7	851.427	7.62	0.00192	728.9515968	452.937112	139659.7945	0.002207812
114	Exh-9	851.427	7.62	0.00192	728.9515968	436.6116335	157185.9111	0.002290365
115	Exh-11	851.427	7.62	0.00192	728.9515968	452.937112	113065.7449	0.002207812
116	Exh-13	851.427	7.62	0.00192	728.9515968	424.4624402	109800.0633	0.002355921
117	Exh-17	851.427	7.62	0.00192	728.9515968	465.0863052	159791.5335	0.002150139
118	Exh-19	851.427	7.62	0.00192	728.9515968	422.5641288	104165.6796	0.002366505
119	Exh-21	851.427	7.62	0.00192	728.9515968	410.4149355	141740.4179	0.002436559
120	Exh-23	851.427	7.62	0.00192	728.9515968	435.8523089	111931.1505	0.002294355
121	Exh-25	851.427	7.62	0.00192	728.9515968	451.7981251	92540.75059	0.002213378
122	Exh-27	851.427	7.62	0.00192	728.9515968	422.5641288	83560.71057	0.002366505
123								
124	#352 PENNZOIL 15W-40 MOTORED 1500 RPM							
125	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
126	Exh-1	863.838	5.715	0.00192	734.1390525	381.5993617	51814.98788	0.00136214
127	Exh-3	863.838	5.715	0.00192	734.1390525	345.6571372	30457.05128	0.00136214
128	Exh-5	863.838	5.715	0.00192	734.1390525	383.128818	67018.37803	0.00136214
129	Exh-7	863.838	5.715	0.00192	734.1390525	393.8350125	57839.86272	0.00136214
130	Exh-11	863.838	5.715	0.00192	734.1390525	379.3051771	49690.42704	0.00136214
131	Exh-13	863.838	5.715	0.00192	734.1390525	361.3340649	45806.93995	0.00136214
132	Exh-15	863.838	5.715	0.00192	734.1390525	357.510424	50626.69736	0.00136214
133	Exh-17	863.838	5.715	0.00192	734.1390525	372.0402594	45258.11513	0.00136214
134	Exh-19	863.838	5.715	0.00192	734.1390525	335.3333068	51440.15224	0.00136214
135	Exh-21	863.838	5.715	0.00192	734.1390525	397.6586534	98962.92219	0.00136214
136								
137	#353 PENNZOIL 15W40 MOTORED 2000 RPM							
138	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
139	Exh-1	857.349	7.62	0.00192	718.4479253	308.7080929	59589.69618	0.001391889
140	Exh-3	857.349	7.62	0.00192	718.4479253	360.3465375	120969.6662	0.001391889
141	Exh-5	857.349	7.62	0.00192	718.4479253	337.1466566	54701.3267	0.001391889
142	Exh-9	857.349	7.62	0.00192	718.4479253	333.4047403	62490.76551	0.001391889
143	Exh-11	857.349	7.62	0.00192	718.4479253	254.0761152	38229.4626	0.001391889
144	Exh-13	857.349	7.62	0.00192	718.4479253	291.1210864	38852.60226	0.001391889
145	Exh-15	857.349	7.62	0.00192	718.4479253	309.4564762	44068.58998	0.001391889
146	Exh-17	857.349	7.62	0.00192	718.4479253	319.1854585	40422.86434	0.001391889

	Q	R	S	T	U	V	W	X
147	Exh-19	857.349	7.62	0.00192	718.4479253	291.1210864	36802.16802	0.001391889
148	Exh-21	857.349	7.62	0.00192	718.4479253	277.2759962	40992.46208	0.001391889
149	Exh-23	857.349	7.62	0.00192	718.4479253	295.6113859	42321.72601	0.001391889
150	Exh-25	857.349	7.62	0.00192	718.4479253	318.4370752	36630.51639	0.001391889
151	Exh-27	857.349	7.62	0.00192	718.4479253	304.9661766	44424.06296	0.001391889
152								
153	#401 Pennzoil SAE30 Motored 1000 rpm							
154	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
155	Exh-1	863.838	3.81	0.00192	1074.978865	588.4389514	159426.0888	0.000930251
156	Exh-3	863.838	3.81	0.00192	1074.978865	649.4663973	191040.682	0.000930251
157	Exh-5	863.838	3.81	0.00192	1074.978865	652.2658214	207203.7285	0.000930251
158	Exh-7	863.838	3.81	0.00192	1074.978865	594.0377996	147494.5376	0.000930251
159	Exh-9	863.838	3.81	0.00192	1074.978865	685.2990261	226949.9037	0.000930251
160	Exh-11	863.838	3.81	0.00192	1074.978865	614.1936533	167415.4746	0.000930251
161	Exh-13	863.838	3.81	0.00192	1074.978865	555.9656315	111895.351	0.000930251
162	Exh-15	863.838	3.81	0.00192	1074.978865	630.9901981	124433.5226	0.000930251
163								
164	#402 Pennzoil SAE30 Motored 1500 rpm							
165	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
166	Exh-2	857.349	5.715	0.00192	962.9447083	604.3481112	173234.6468	0.001038481
167	Exh-4	857.349	5.715	0.00192	962.9447083	588.8005664	132408.2967	0.001038481
168	Exh-6	857.349	5.715	0.00192	962.9447083	561.2162128	155314.2278	0.001038481
169	Exh-8	857.349	5.715	0.00192	962.9447083	579.7729598	112984.3713	0.001038481
170	Exh-10	857.349	5.715	0.00192	962.9447083	546.1702017	122594.4183	0.001038481
171	Exh-12	857.349	5.715	0.00192	962.9447083	558.7085443	119069.0071	0.001038481
172	Exh-14	857.349	5.715	0.00192	962.9447083	547.6748028	118698.6808	0.001038481
173	Exh-16	857.349	5.715	0.00192	962.9447083	588.8005664	142831.2231	0.001038481
174	Exh-18	857.349	5.715	0.00192	962.9447083	575.7606902	146309.0206	0.001038481
175	Exh-20	857.349	5.715	0.00192	962.9447083	607.3573134	161073.8419	0.001038481
176	Exh-22	857.349	5.715	0.00192	962.9447083	536.6410614	98387.43625	0.001038481
177								
178	#403 Pennzoil SAE30 Motored 2000 rpm							
179	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
180	Exh-2	851.427	7.62	0.00192	917.4622201	478.8005961	93904.73537	0.001089963
181	Exh-4	851.427	7.62	0.00192	917.4622201	549.9994872	119623.3754	0.001089963
182	Exh-6	851.427	7.62	0.00192	917.4622201	584.4043204	151047.5843	0.001089963
183	Exh-8	851.427	7.62	0.00192	917.4622201	532.3192256	162087.5489	0.001089963
184	Exh-10	851.427	7.62	0.00192	917.4622201	567.6797487	114825.4628	0.001089963
185	Exh-12	851.427	7.62	0.00192	917.4622201	549.9994872	180597.7111	0.001089963
186	Exh-14	851.427	7.62	0.00192	917.4622201	549.0437974	96116.25905	0.001089963
187	Exh-18	851.427	7.62	0.00192	917.4622201	532.3192256	109883.6725	0.001089963
188	Exh-22	851.427	7.62	0.00192	917.4622201	496.4808577	100936.2765	0.001089963
189	Exh-24	851.427	7.62	0.00192	917.4622201	569.5911283	194316.4471	0.001089963
190	Exh-26	851.427	7.62	0.00192	917.4622201	582.9707857	136021.4697	0.001089963
191	Exh-28	851.427	7.62	0.00192	917.4622201	532.3192256	172875.2881	0.001089963
192								
193	#404 Pennzoil SAE30 Motored 2500 rpm							
194	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
195	Exh-3	846.009	9.525	0.00192	757.3323466	355.3939814	77275.92762	0.001320424
196	Exh-5	846.009	9.525	0.00192	757.3323466	377.0883976	71501.81887	0.001320424
197	Exh-9	846.009	9.525	0.00192	757.3323466	370.7772947	72917.06073	0.001320424
198	Exh-17	846.009	9.525	0.00192	757.3323466	427.9716646	62451.41143	0.001320424
199	Exh-19	846.009	9.525	0.00192	757.3323466	399.1772577	54581.00961	0.001320424
200	Exh-21	846.009	9.525	0.00192	757.3323466	478.4604877	160164.0788	0.001320424
201	Exh-23	846.009	9.525	0.00192	757.3323466	401.9383652	56358.92409	0.001320424
202	Exh-27	846.009	9.525	0.00192	757.3323466	363.6773039	69873.73922	0.001320424

	Y	Z	AA	AB	AC	AD	AE	AF
1	**#201 Cummins 15W40 Motored 1000 rpm**							
2	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
3	Exh-2	0.003913695	2.100121317	0.013713011	1.430219656	0.681017637	0.003236678	0.003359597
4	Exh-4	0.001259041	1.298110768	0.019326996	1.06643585	0.821529161	0.004710085	0.004888959
5	Exh-6	0.002222934	1.592567794	0.015248147	1.122911923	0.70509521	0.003469591	0.003601355
6	Exh-8	0.002084832	1.477756869	0.020633282	1.158556174	0.783996473	0.004289543	0.004452446
7	Exh-10	0.001756693	1.374520605	0.02383857	1.163277266	0.846314898	0.004998581	0.005188412
8	Exh-12	0.001662457	1.383834775	0.020326019	1.142740513	0.825778145	0.004758933	0.004939662
9	Exh-14	0.001747585	1.398755348	0.020811521	1.061124621	0.7586206	0.004016355	0.004168883
10								
11	**#202 Cummins 15W40 Motored 1500 rpm**							
12	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
13	Exh-2	0.001508312	1.337813797	0.018916383	1.562145324	1.167685165	0.002178953	0.002605131
14	Exh-8	0.002321546	1.529817369	0.018218513	1.894747484	1.238544889	0.002451432	0.002930904
15	Exh-10	0.001508312	1.340167197	0.018655548	1.554066854	1.159606695	0.002148908	0.00256921
16	Exh-12	0.001546708	1.406902836	0.013710267	1.461164447	1.03856813	0.001723719	0.002060858
17	Exh-14	0.001395663	1.373229825	0.013268422	1.451470283	1.056975501	0.001785362	0.002134558
18	Exh-20	0.001142047	1.304505608	0.013347127	1.327523468	1.017644892	0.001654965	0.001978658
19	Exh-22	0.001944893	1.448704482	0.017827134	1.90998117	1.318406338	0.002777762	0.00332106
20								
21	**#203 Cummins 15W40 Motored 2000 rpm**							
22	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
23	Exh-1	0.001598257	1.322909778	0.021745267	2.668963928	2.01749505	0.002230815	0.002849851
24	Exh-3	0.00106954	1.258542689	0.015190202	2.49208765	1.98013756	0.002148965	0.002745288
25	Exh-5	0.001627303	1.436152327	0.012356477	2.604922517	1.81382049	0.001803131	0.002303487
26	Exh-9	0.002110298	1.537679062	0.013673357	2.794759557	1.81751812	0.00181049	0.002312889
27	Exh-13	0.001057342	1.212058031	0.022067606	2.659243357	2.193990129	0.002638202	0.003370285
28	Exh-15	0.001748276	1.574389986	0.008223187	2.550601677	1.620057102	0.001438465	0.001837629
29	Exh-19	0.001712703	1.380419837	0.017991691	2.870236935	2.079249268	0.002369473	0.003026986
30	Exh-21	0.001691963	1.394719025	0.016309465	2.630653441	1.886152977	0.001949811	0.00249087
31	Exh-23	0.001777542	1.37598349	0.01983975	4.066629606	2.955434884	0.004787198	0.006115613
32	Exh-25	0.002355621	1.595823695	0.013874243	2.866615545	1.796323462	0.001768511	0.002259261
33	Exh-27	0.001004688	1.207233212	0.020863046	2.710324006	2.245070779	0.002762477	0.003529046
34								
35	**#204 Cummins 15W40 Motored 2500 rpm**							
36	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
37	Exh-2	0.00094086	1.237216937	0.013418615	3.258033967	2.633357069	0.001640769	0.00210169
38	Exh-4	0.001176425	1.37794291	0.008264669	3.290452215	2.387945241	0.001349201	0.001728216
39	Exh-6	0.001045623	1.269111633	0.0128776	3.27395872	2.579724774	0.001574616	0.002016954
40	Exh-10	0.001299922	1.344259323	0.012162222	3.79492566	2.823060697	0.001885682	0.002415403
41	Exh-12	0.001011743	1.246666128	0.01435064	3.509133207	2.814813949	0.001874681	0.002401312
42	Exh-14	0.000629533	1.148159572	0.015400203	3.175566493	2.765788458	0.001809947	0.002318394
43	Exh-16	0.000768573	1.143444687	0.02448789	3.873980687	3.387991331	0.002715892	0.003478835
44	Exh-22	0.000721424	1.222859881	0.008938557	3.047884093	2.492423	0.001469845	0.00188275
45	Exh-24	0.000549918	1.117122302	0.018804707	3.31178001	2.964563507	0.002079455	0.002663611
46	Exh-28	0.000994574	1.241335369	0.014487115	3.213387782	2.588654011	0.001585536	0.002030941
47	Exh-30	0.000757435	1.13904483	0.025312221	3.981188403	3.495199047	0.002890492	0.003702483
48	Exh-34	0.001723968	1.489175213	0.010594459	3.382019548	2.271068924	0.001220362	0.001563183
49								
50								
51	**#251 Havoline SAE30 Motored 1000 rpm**							
52	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
53	Exh-1	0.002868346	2.605556967	0.003448397	0.942297298	0.361649087	0.00091536	0.0009501 23
54	Exh-3	0.003734472	2.71896136	0.005099548	1.377636164	0.50667736	0.00179672	0.001864953
55	Exh-5	0.002805414	2.044296578	0.007797433	1.162453146	0.56863234	0.002262978	0.002348919
56	Exh-7	0.003393867	2.818757466	0.003762233	1.186236248	0.420836579	0.001239494	0.001286566
57	Exh-9	0.002397506	2.346302803	0.003426412	0.988944609	0.421490614	0.001243349	0.001290568
58	Exh-11	0.003873115	2.937366523	0.0043182	1.36050152	0.4631705	0.001501409	0.001558428
59	Exh-13	0.003503567	3.010150366	0.003282232	1.205424887	0.40045338	0.001122332	0.001164954
60	Exh-15	0.003823092	3.162499148	0.003376938	1.254450508	0.396664299	0.001101193	0.001143013
61								
62	**#252 Havoline SAE30 Motored 1500 rpm**							
63	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
64	Exh-3	0.002310574	2.253663817	0.003330443	1.778696916	0.789246782	0.000963403	0.001151834
65	Exh-7	0.002810543	2.625778311	0.002930099	1.727545277	0.657917414	0.000669461	0.0008004
66	Exh-9	0.0025245	2.382105511	0.003271092	1.659306581	0.696571404	0.000750436	0.000897213
67	Exh-11	0.002310053	1.854826356	0.007159995	1.856793529	1.00106057	0.001549899	0.001853041
68	Exh-13	0.002765353	2.347187927	0.004131135	1.863694071	0.794011442	0.000975071	0.001165783
69	Exh-15	0.001787594	1.808155313	0.004797034	1.70771991	0.944454217	0.001379572	0.0016494
70	Exh-17	0.003401802	2.695293513	0.00394778	2.125805144	0.788710073	0.000962094	0.001150268
71	Exh-19	0.002785185	2.262057788	0.004775008	1.773329827	0.783945413	0.000950505	0.001136412
72	Exh-21	0.00221744	2.513571137	0.002104372	1.820757364	0.724370732	0.00081153	0.000970255
73								

	Y	Z	AA	AB	AC	AD	AE	AF
74	#253 Havoline SAE30 Motored 2000 rpm							
75	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
76	Exh-1	0.001369347	1.743377651	0.003203096	2.558569996	1.467593664	0.001109998	0.001418015
77	Exh-7	0.001134094	1.383240364	0.008266428	2.46082227	1.779027228	0.001631082	0.002083696
78	Exh-9	0.001666451	1.494956663	0.010700707	2.745687071	1.836633221	0.001738423	0.002220824
79	Exh-13	0.001640691	1.658272489	0.005864141	2.862798156	1.726373787	0.001535961	0.00196218
80	Exh-17	0.000991404	1.293156936	0.010795999	2.405897358	1.860483666	0.001783867	0.002278877
81	Exh-21	0.001451459	1.637467363	0.004893909	2.335332809	1.426185866	0.001048245	0.001339126
82	Exh-25	0.000870145	1.180814815	0.021861357	2.967993328	2.513512949	0.003255914	0.004159408
83	Exh-27	0.000956563	1.381916199	0.005921792	2.138161682	1.547244097	0.001233753	0.001576111
84								
85	#301 MOBIL 1 MOTORED 1000 RPM							
86	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
87	Exh-1	0.00552499	3.012949536	0.006634041	1.153010854	0.382685087	0.001257549	0.001305307
88	Exh-3	0.004023722	2.511583783	0.006239825	1.167023864	0.464656553	0.001853984	0.001924393
89	Exh-5	0.004083729	2.637325789	0.005478031	1.167812675	0.442801826	0.001683685	0.001747626
90	Exh-7	0.004141755	2.529182879	0.006459975	1.236578504	0.488924116	0.002052697	0.002130652
91	Exh-9	0.002911385	2.091929958	0.006260234	1.019980063	0.487578496	0.002041414	0.00211894
92	Exh-11	0.003879792	2.335643294	0.00743048	1.188553786	0.508876415	0.002223651	0.002308098
93	Exh-13	0.003818393	2.473766286	0.005911326	1.140900273	0.461199701	0.001826501	0.001895866
94	Exh-15	0.002114586	1.724137931	0.007509121	0.863052915	0.500570691	0.002151656	0.002233369
95								
96	#302 Mobil 1 Motored 1500 rpm							
97	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
98	Exh-1	0.00286897	1.788708505	0.010262897	2.021145401	1.129946772	0.002496159	0.002984379
99	Exh-3	0.002575872	1.85646958	0.007015771	1.977247137	1.065057655	0.002217699	0.002651455
100	Exh-5	0.003039785	1.830191469	0.010398725	2.25943722	1.234535981	0.00297964	0.003562423
101	Exh-7	0.002449704	1.802799089	0.007222115	1.951510526	1.08248919	0.002290886	0.002738956
102	Exh-9	0.002927501	2.109431513	0.005400626	2.075904149	0.984105972	0.00189339	0.002263715
103	Exh-11	0.001947003	1.51200866	0.011215778	2.03967211	1.348981765	0.003557693	0.004253536
104	Exh-13	0.003244409	2.11092033	0.006615401	2.244013506	1.063049834	0.002209345	0.002641467
105	Exh-17	0.002635732	1.939785538	0.006100928	1.931614847	0.995787838	0.001938608	0.002317777
106	Exh-19	0.002698429	1.646962903	0.013493172	2.212253432	1.343232096	0.00352743	0.004217355
107								
108	#303 Mobil 1 Motored 2000 rpm							
109	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
110	Exh-1	0.002665385	1.93594539	0.00591177	3.135094429	1.619412637	0.001750205	0.002235875
111	Exh-3	0.002459386	1.849075599	0.006115885	3.059378484	1.654544836	0.001826968	0.00233394
112	Exh-5	0.002001076	1.534702259	0.010209436	3.395405849	2.21241992	0.003266699	0.004173185
113	Exh-7	0.001937585	1.724096386	0.005219481	2.817087459	1.633950099	0.00178177	0.002276199
114	Exh-9	0.003454567	2.369620873	0.004637512	3.51806568	1.484653398	0.001471039	0.001879242
115	Exh-11	0.002058358	1.692128085	0.006447148	3.072855922	1.815971231	0.002200857	0.00281158
116	Exh-13	0.002067566	1.685110488	0.0066389	2.91006664	1.726929279	0.001990321	0.002542621
117	Exh-17	0.002063519	1.824869666	0.004561891	2.862365595	1.568531522	0.001641952	0.002097583
118	Exh-19	0.002011728	1.649279341	0.006998002	2.911126663	1.765090116	0.002079255	0.002656234
119	Exh-21	0.002338674	1.880473982	0.005142863	2.763632002	1.469646497	0.00144145	0.001841443
120	Exh-23	0.002139043	1.715640628	0.0065125	3.013191757	1.756307066	0.002058614	0.002629865
121	Exh-25	0.001578241	1.480108909	0.007877088	2.963522097	2.002232456	0.002675488	0.003417917
122	Exh-27	0.001946868	1.562778546	0.008723617	3.079821789	1.970734623	0.002591972	0.003311226
123								
124	#352 PENNZOIL 15W-40 MOTORED 1500 RPM							
125	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
126	Exh-1	0.001226905	1.279279279	0.014168469	1.650020346	1.289804637	0.003384756	0.004046775
127	Exh-3	0.003132369	1.546659405	0.024104075	2.35689526	1.523861849	0.004724661	0.005648751
128	Exh-5	0.002138669	1.553656759	0.010954295	1.769077817	1.138654215	0.00263793	0.003153878
129	Exh-7	0.002600663	1.625457473	0.012692614	2.047954495	1.259924993	0.00322975	0.003861452
130	Exh-11	0.001774383	1.395533953	0.014774255	1.826992683	1.309171073	0.003487163	0.004169212
131	Exh-13	0.001781692	1.381327654	0.016026808	1.794254184	1.298934528	0.003432844	0.004104268
132	Exh-15	0.002946708	1.663020519	0.014501026	2.033014673	1.222483217	0.003040642	0.003635357
133	Exh-17	0.002202412	1.468540096	0.016221158	1.975929798	1.345506196	0.003683417	0.004403851
134	Exh-19	0.002268706	1.514552088	0.014271712	1.722875034	1.137547562	0.002632805	0.003147751
135	Exh-21	0.00220762	1.69448132	0.007418324	1.647991482	0.972563971	0.001924491	0.002300899
136								
137	#353 PENNZOIL 15W40 MOTORED 2000 RPM							
138	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
139	Exh-1	0.001669611	1.407568871	0.01205658	2.416456002	1.716758626	0.001968228	0.002514398
140	Exh-3	0.002225152	1.773923282	0.005939075	2.494960964	1.406464975	0.001321036	0.001687615
141	Exh-5	0.000934176	1.218488079	0.013134013	2.384448907	1.956891453	0.002557351	0.003266999
142	Exh-9	0.001116705	1.279155673	0.011496865	2.315976019	1.810550559	0.002189164	0.002796642
143	Exh-11	0.00196398	1.384004333	0.018793043	2.441456568	1.764052691	0.002078165	0.002654842
144	Exh-13	0.000983552	1.193868636	0.018491629	2.393684785	2.004981714	0.002684589	0.003429544
145	Exh-15	0.001388104	1.291398106	0.016302948	2.584294198	2.001159972	0.002674364	0.003416482
146	Exh-17	0.001435465	1.288606473	0.017773306	2.77713296	2.155144351	0.00310177	0.00396249

	Y	Z	AA	AB	AC	AD	AE	AF
147	Exh-19	0.002065823	1.396305171	0.019521891	2.876498268	2.060078504	0.00283416	0.003620621
148	Exh-21	0.002788742	1.564625268	0.017526342	2.908823841	1.859118538	0.002308187	0.002948694
149	Exh-23	0.001453117	1.298938776	0.016975865	2.533815348	1.950681122	0.002541145	0.003246296
150	Exh-25	0.001798732	1.344261139	0.019613371	3.036215261	2.25864988	0.003406863	0.004352245
151	Exh-27	0.00122084	1.257316579	0.016172495	2.46964192	1.96421646	0.002576532	0.003291503
152								
153	#401 Pennzoil SAE30 Motored 1000 rpm							
154	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
155	Exh-1	0.002732996	2.09123591	0.006742804	1.05386801	0.503945062	0.001786444	0.001854287
156	Exh-3	0.002384029	2.042015997	0.005626963	1.037562753	0.508107064	0.001816073	0.001885042
157	Exh-5	0.002090381	1.951533926	0.005188029	0.956232327	0.489990112	0.001688875	0.001753013
158	Exh-7	0.002000959	1.768468802	0.007288262	0.935373349	0.528917077	0.001967878	0.002042611
159	Exh-9	0.002193554	2.044993032	0.004736635	1.005931534	0.491899737	0.001702065	0.001766704
160	Exh-11	0.002504389	2.024706668	0.006421025	1.039276519	0.513297326	0.001853365	0.00192375
161	Exh-13	0.002263672	1.757215473	0.009607002	0.998684753	0.568333689	0.002272112	0.0023584
162	Exh-15	0.002216236	1.781780339	0.008638981	1.089857091	0.61166748	0.002631805	0.002731753
163								
164	#402 Pennzoil SAE30 Motored 1500 rpm							
165	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
166	Exh-2	0.002642655	2.099911661	0.005558615	2.328306511	1.108764028	0.001935905	0.002314546
167	Exh-4	0.002233821	1.812841855	0.007272541	2.239957999	1.235605849	0.002404173	0.002874401
168	Exh-6	0.003292125	2.297423888	0.006199977	2.498245167	1.087411505	0.00186206	0.002226257
169	Exh-8	0.002268604	1.762549267	0.008522813	2.321450196	1.317098046	0.002731757	0.003266057
170	Exh-10	0.002465483	1.863251377	0.007854719	2.219389055	1.191137751	0.00223424	0.002671231
171	Exh-12	0.002410153	1.8316565	0.008087283	2.264640732	1.236389428	0.002407223	0.002878048
172	Exh-14	0.002630149	1.906156701	0.008112514	2.313810303	1.213861537	0.0023203	0.002774124
173	Exh-16	0.003031584	2.145726988	0.006741836	2.552703895	1.189668541	0.002228731	0.002664646
174	Exh-18	0.002230054	1.853003835	0.006581581	2.129865175	1.149412179	0.00208045	0.002487363
175	Exh-20	0.002629562	2.055348364	0.005978281	2.375125345	1.155582862	0.002102848	0.002514141
176	Exh-22	0.002801109	1.878617484	0.009787273	2.454266806	1.306421785	0.002687649	0.003213323
177								
178	#403 Pennzoil SAE30 Motored 2000 rpm							
179	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
180	Exh-2	0.002430178	1.744700821	0.009770138	3.675094264	2.106432358	0.00235277	0.003005648
181	Exh-4	0.002332676	1.806793729	0.00766959	3.873463021	2.143832447	0.00243706	0.003113327
182	Exh-6	0.001837752	1.714239272	0.006073995	3.475077926	2.02718371	0.002179067	0.002783744
183	Exh-8	0.002858527	2.150845734	0.005660288	3.833921076	1.782517925	0.001684815	0.00215234
184	Exh-10	0.001629251	1.552086373	0.007990059	3.505393417	2.258504087	0.002704744	0.003455293
185	Exh-12	0.003092163	2.314069877	0.0050080143	4.037562093	1.74478832	0.001614247	0.002062189
186	Exh-14	0.002282425	1.707611621	0.009545338	4.076939279	2.387509683	0.003022559	0.003861298
187	Exh-18	0.00140114	1.464459665	0.008349395	3.170440192	2.164921484	0.002485242	0.00317488
188	Exh-22	0.002944746	1.935559553	0.009089519	4.07776307	2.106761874	0.002353506	0.003006588
189	Exh-24	0.002409499	2.062139412	0.004721485	3.592220938	1.741987432	0.001609068	0.002055574
190	Exh-26	0.002252107	1.830601515	0.006744981	3.900977624	2.130981315	0.002407929	0.003076113
191	Exh-28	0.003475184	2.444921726	0.005307076	4.219949313	1.726005896	0.00157968	0.00201803
192								
193	#404 Pennzoil SAE30 Motored 2500 rpm							
194	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
195	Exh-3	0.001247548	1.346800284	0.009800366	3.603921537	2.675913853	0.00190825	0.002444311
196	Exh-5	0.001240784	1.331783389	0.010591791	3.930994097	2.951676773	0.00232182	0.002974061
197	Exh-9	0.001461338	1.394607303	0.010386216	4.008064133	2.873973286	0.002201184	0.002819536
198	Exh-17	0.000517873	1.129418002	0.012126745	4.048393932	3.584495665	0.003424105	0.004385997
199	Exh-19	0.001234041	1.288303714	0.013875382	4.60731005	3.576260785	0.00340839	0.004365868
200	Exh-21	0.001494888	1.59826175	0.004728478	3.999406951	2.50234791	0.001668731	0.002137507
201	Exh-23	0.001225312	1.290889591	0.013437665	4.574581679	3.543743564	0.00334669	0.004286835
202	Exh-27	0.000677111	1.178985188	0.010838583	3.395093414	2.879674357	0.002209926	0.002830734

	AG	AH	AI	AJ	AK	AL
1	#201 Cummins 15W40 Motored 1000 rpm					
2	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
3	Exh-2	0.08544	2.612844037	1.740381282	18412.97217	1079610.052
4	Exh-4	0.06591	2.01559633	1.473457367	15263.68069	894957.2588
5	Exh-6	0.0708	2.165137615	1.592567794	17784.20647	1042743.555
6	Exh-8	0.08545	2.613149847	1.643206624	15994.40714	937802.0324
7	Exh-10	0.06348	1.941284404	1.442646956	14816.65845	868746.9493
8	Exh-12	0.05859	1.791743119	1.418709355	15185.14249	890352.319
9	Exh-14	0.083	2.5382263	1.645663166	16529.42037	969171.5286
10						
11	#202 Cummins 15W40 Motored 1500 rpm					
12	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
13	Exh-2	0.01465	0.448012232	1.144791461	23980.83784	1847010.279
14	Exh-8	0.00977	0.298776758	1.091036154	22608.84432	1741338.986
15	Exh-10	0.05127	1.567889908	1.510250796	24147.9018	1859877.588
16	Exh-12	0.046388	1.418593272	1.515468042	26962.18745	2076634.59
17	Exh-14	0.031743	0.970733945	1.34658849	26492.63731	2040469.717
18	Exh-20	0.031741	0.970672783	1.359960988	27516.54218	2119331.133
19	Exh-22	0.03906	1.194495413	1.341911765	21239.331	1635858.718
20						
21	#203 Cummins 15W40 Motored 2000 rpm					
22	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
23	Exh-1	0.04638	1.418348624	1.438167218	24504.4457	2354029.287
24	Exh-3	0.06836	2.090519878	1.658003658	24966.74923	2398440.658
25	Exh-5	0.080566	2.463792049	1.846601656	27256.05878	2618364.087
26	Exh-9	0.078122	2.389051988	1.819249565	27200.608	2613037.186
27	Exh-13	0.03173	0.970336391	1.275649379	22533.19066	2164659.891
28	Exh-15	0.068352	2.090275229	1.804160098	30515.96011	2931527.801
29	Exh-19	0.03418	1.045259939	1.313319278	23776.6576	2284114.034
30	Exh-21	0.019531	0.597278287	1.197364565	26210.81031	2517951.879
31	Exh-23	0.03418	1.045259939	1.220430801	16727.68978	1606952.148
32	Exh-25	0.039064	1.194617737	1.41448974	27521.5455	2643868.175
33	Exh-27	0.0293	0.896024465	1.248747771	22020.50749	2115408.778
34						
35	#204 Cummins 15W40 Motored 2500 rpm					
36	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
37	Exh-2	0.063477	1.941192661	1.685474553	29147.08992	3363470.946
38	Exh-4	0.065917	2.015810398	1.784978505	32142.56925	3709138.652
39	Exh-6	0.053713	1.642599388	1.592094095	29753.05585	3433397.268
40	Exh-10	0.075686	2.314556575	1.762394988	27188.46795	3137452.908
41	Exh-12	0.014646	0.447889908	1.147963307	27268.12381	3146644.912
42	Exh-14	0.0193	0.590214067	1.198437179	27751.46995	3202421.345
43	Exh-16	0.00031	0.009480122	1.002601981	22654.92671	2614298.305
44	Exh-22	0.073243	2.239847095	1.83565895	30795.21225	3553658.425
45	Exh-24	0.04395	1.344036697	1.421582734	25890.72391	2987697.842
46	Exh-28	0.056149	1.717094801	1.616811855	29650.42642	3421554.196
47	Exh-30	0.03418	1.045259939	1.278089659	21960.03554	2534110.325
48	Exh-34	0.024417	0.746697248	1.305736073	33796.72649	3900022.539
49						
50						
51	#251 Havoline SAE30 Motored 1000 rpm					
52	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
53	Exh-1	0.004883	0.137162921	1.0729819	34673.2765	2027231.829
54	Exh-3	0.019532	0.548651685	1.208368004	24748.60687	1446969.212
55	Exh-5	0.06347	1.782865169	1.603326996	22052.13793	1289315.589
56	Exh-7	0.031743	0.891657303	1.407709005	29796.7416	1742116.958
57	Exh-9	0.034182	0.960168539	1.438354408	29750.50541	1739413.681
58	Exh-11	0.048831	1.371657303	1.56986311	27073.31059	1582886.952
59	Exh-13	0.021973	0.617219101	1.296587749	31313.40484	1830791.243
60	Exh-15	0.019531	0.548623596	1.266144307	31612.52178	1848279.621
61						
62	#252 Havoline SAE30 Motored 1500 rpm					
63	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
64	Exh-3	0.019531	0.548623596	1.27105307	35479.48402	2823553.903
65	Exh-7	0.024414	0.685786517	1.406452902	42561.67716	3387174.108
66	Exh-9	0.031739	0.891544944	1.499080116	40199.85377	3199213.775
67	Exh-11	0.014646	0.411404494	1.16025122	27972.40191	2226119.877
68	Exh-13	0.041499	1.165702247	1.572471065	35266.58068	2806610.476
69	Exh-15	0.023294	0.654325843	1.270150535	29648.94232	2359543.525
70	Exh-17	0.012207	0.342893258	1.169525185	35503.62743	2825475.301
71	Exh-19	0.021973	0.617219101	1.307005533	35719.41123	2842647.963
72	Exh-21	0.004883	0.137162921	1.073836058	38657.09555	3076436.877
73						

	AG	AH	AI	AJ	AK	AL
74	#253 Havoline SAE30 Motored 2000 rpm					
75	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
76	Exh-1	0.009766	0.274325843	1.123896275	33686.16198	3441489.902
77	Exh-7	0.014649	0.411488764	1.153310797	27789.11819	2839028.372
78	Exh-9	0.007325	0.205758427	1.074256171	26917.51261	2749982.26
79	Exh-13	0.019527	0.548511236	1.210594998	28636.67086	2925617.161
80	Exh-17	0.014644	0.411348315	1.146548446	26572.44393	2714728.899
81	Exh-21	0.004883	0.137162921	1.063746736	34664.20407	3541409.922
82	Exh-25	0.01709	0.48005618	1.126592593	19668.72616	2009422.222
83	Exh-27	0.004883	0.137162921	1.058759115	31952.03523	3264325.768
84						
85	#301 MOBIL 1 MOTORED 1000 RPM					
86	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
87	Exh-1	0.029296	0.866745562	1.355214977	32767.30459	1561437.544
88	Exh-3	0.04168	1.233136095	1.416217296	26986.72537	1285979.629
89	Exh-5	0.04639	1.372485207	1.486115477	28318.67	1349449.859
90	Exh-7	0.02929	0.866568047	1.277972858	25647.24949	1222150.517
91	Exh-9	0.04638	1.372189349	1.441377998	25718.03082	1225523.411
92	Exh-11	0.03174	0.939053254	1.289413696	24641.65842	1174231.786
93	Exh-13	0.119625	3.539201183	2.203531365	27189.00024	1295618.492
94	Exh-15	0.08301	2.45591716	1.769466073	25050.52538	1193715.239
95						
96	#302 Mobil 1 Motored 1500 rpm					
97	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
98	Exh-1	0.02441	0.722189349	1.197156934	24781.75901	1560188.999
99	Exh-3	0.07066	2.090532544	1.605484147	26291.59883	1655244.216
100	Exh-5	0.02929	0.866568047	1.216529903	22682.26202	1428010.645
101	Exh-7	0.05127	1.516863905	1.432256977	25868.22008	1628589.495
102	Exh-9	0.03418	1.011242604	1.316980432	28454.32239	1791403.135
103	Exh-11	0.015	0.443786982	1.101481632	20757.92966	1306860.158
104	Exh-13	0.03662	1.083431953	1.314388736	26341.25673	1658370.536
105	Exh-17	0.06104	1.80591716	1.559435432	28120.51676	1770387.682
106	Exh-19	0.02442	0.722485207	1.165919283	20846.78342	1312454.138
107						
108	#303 Mobil 1 Motored 2000 rpm					
109	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
110	Exh-1	0.04638	1.372189349	1.433701141	30528.1043	2408415.934
111	Exh-3	0.0415	1.227810651	1.379827933	29879.87804	2357276.222
112	Exh-5	0.02441	0.722189349	1.167077344	22345.48579	1762874.743
113	Exh-7	0.03906	1.155621302	1.362001854	30256.49188	2386987.952
114	Exh-9	0.083009	2.455887574	1.84667639	33299.08379	2627023.388
115	Exh-11	0.02685	0.794378698	1.223899266	27223.77814	2147731.821
116	Exh-13	0.03418	1.011242604	1.299719397	28627.45944	2258470.712
117	Exh-17	0.05371	1.589053254	1.518536397	31518.39616	2486541.803
118	Exh-19	0.03672	1.086390533	1.315030885	28008.54045	2209643.102
119	Exh-21	0.04639	1.372485207	1.47800103	33639.10844	2653848.532
120	Exh-23	0.0415	1.227810651	1.357820314	28148.6073	2220693.223
121	Exh-25	0.03418	1.011242604	1.258508546	24691.23789	1947935.259
122	Exh-27	0.03662	1.083431953	1.281389273	25085.87271	1979068.695
123						
124	#352 PENNZOIL 15W-40 MOTORED 1500 RPM					
125	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
126	Exh-1	0.03174	0.994984326	1.226941227	21874.63626	1303507.079
127	Exh-3	0.02685	0.84169279	1.162490922	18514.80651	1103295.207
128	Exh-5	0.03418	1.071473354	1.276828379	24778.3804	1476540.86
129	Exh-7	0.05371	1.68369906	1.393134241	22393.40234	1334420.29
130	Exh-11	0.05371	1.68369906	1.378346013	21551.04697	1284224.429
131	Exh-13	0.03174	0.994984326	1.225346113	21720.88482	1294345.048
132	Exh-15	0.09033	2.831661442	1.681427278	23079.25941	1375290.435
133	Exh-17	0.02442	0.765517241	1.167374914	20969.0653	1249544.208
134	Exh-19	0.03662	1.147962382	1.2968788	24802.48583	1477977.3
135	Exh-21	0.01953	0.612225705	1.185188697	29009.9244	1728698.085
136						
137	#353 PENNZOIL 15W40 MOTORED 2000 RPM					
138	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
139	Exh-1	0.04394	1.377429467	1.407568871	28997.35264	2254688.804
140	Exh-3	0.061036	1.913354232	1.691046601	35394.73515	2752117.205
141	Exh-5	0.02685	0.84169279	1.218488079	25439.04783	1978012.857
142	Exh-9	0.05127	1.607210031	1.450923483	27495.20306	2137889.182
143	Exh-11	0.03034	0.951097179	1.273876151	28219.9367	2194240.838
144	Exh-13	0.04395	1.377742947	1.349058852	24828.88244	1930569.454
145	Exh-15	0.00976	0.305956113	1.077663722	24876.29973	1934256.386
146	Exh-17	0.0122	0.382445141	1.090143343	23098.89602	1796054.382

	AG	AH	AI	AJ	AK	AL
147	Exh-19	0.01465	0.459247649	1.113241091	24164.8341	1878936.384
148	Exh-21	0.02197	0.688714734	1.188179872	26776.91296	2082038.544
149	Exh-23	0.01709	0.535736677	1.139510204	25520.03745	1984310.204
150	Exh-25	0.00977	0.306269592	1.068880429	22040.35947	1713747.885
151	Exh-27	0.03174	0.994984326	1.257316579	25344.17988	1970636.4
152						
153	**#401 Pennzoil SAE30 Motored 1000 rpm**					
154	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
155	Exh-1	0.06104	1.56112532	1.593082005	24882.78931	1447444.617
156	Exh-3	0.08301	2.123017903	1.79994218	24678.96961	1435588.32
157	Exh-5	0.06592	1.685933504	1.658738883	25591.45274	1488667.932
158	Exh-7	0.05372	1.373913043	1.497315312	23707.98626	1379105.721
159	Exh-9	0.05127	1.311253197	1.510352379	25492.10309	1482888.712
160	Exh-11	0.06104	1.56112532	1.582276066	24429.42551	1421072.212
161	Exh-13	0.04395	1.124040921	1.378650814	22063.72599	1283458.258
162	Exh-15	0.02441	0.624296675	1.195405059	20500.6138	1192531.22
163						
164	**#402 Pennzoil SAE30 Motored 1500 rpm**					
165	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
166	Exh-2	0.0122	0.31202046	1.107773852	25255.21021	1973997.35
167	Exh-4	0.02442	0.62455243	1.193579073	22662.62224	1771355.529
168	Exh-6	0.05127	1.311253197	1.461808683	25751.12408	2012758.962
169	Exh-8	0.02441	0.624296675	1.181527478	21260.42831	1661757.269
170	Exh-10	0.01465	0.374680307	1.120467067	23508.67359	1837484.582
171	Exh-12	0.02929	0.749104859	1.232036758	22648.25949	1770232.908
172	Exh-14	0.0293	0.749360614	1.236423788	23068.58545	1803086.42
173	Exh-16	0.03907	0.999232737	1.321669685	23537.7062	1839753.828
174	Exh-18	0.01954	0.499744246	1.166510439	24362.07751	1904188.326
175	Exh-20	0.02442	0.62455243	1.206984235	24231.98674	1894020.173
176	Exh-22	0.04395	1.124040921	1.329509672	21434.17151	1675337.382
177						
178	**#403 Pennzoil SAE30 Motored 2000 rpm**					
179	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
180	Exh-2	0.01708	0.436828645	1.133594056	23469.82457	2330402.816
181	Exh-4	0.00244	0.062404092	1.018751921	23060.38327	2289747.925
182	Exh-6	0.01708	0.436828645	1.138816645	24387.3299	2421505.202
183	Exh-8	0.00489	0.125063939	1.045198262	27734.69887	2753877.438
184	Exh-10	0.01465	0.374680307	1.1068719	21889.53218	2173489.933
185	Exh-12	0.04638	1.186189258	1.43796034	28334.43882	2813427.762
186	Exh-14	0.00977	0.249872123	1.067421158	20706.76331	2056048.582
187	Exh-18	0.03418	0.874168798	1.260121766	22835.74636	2267442.922
188	Exh-22	0.02441	0.624296675	1.190897005	23466.15368	2330038.32
189	Exh-24	0.02685	0.686700767	1.253948737	28379.99689	2817951.386
190	Exh-26	0.02442	0.62455243	1.188804701	23199.45161	2303556.518
191	Exh-28	0.0293	0.749360614	1.279686903	28642.77464	2844043.528
192						
193	**#404 Pennzoil SAE30 Motored 2500 rpm**					
194	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	tau (N/m^2)	Shear rate (1/s)
195	Exh-3	0.03662	0.93657289	1.288960783	28683.54495	2938747.731
196	Exh-5	0.04394	1.123785166	1.314328636	26003.7603	2664192.718
197	Exh-9	0.04151	1.061636829	1.304973918	26706.8228	2736224.377
198	Exh-17	0.02197	0.561892583	1.129418002	21412.9692	2193847.196
199	Exh-19	0.02198	0.562148338	1.129775049	21462.2758	2198898.86
200	Exh-21	0.00987	0.252429668	1.083284111	30673.07106	3142582.904
201	Exh-23	0.01464	0.374424552	1.087231127	21659.21261	2219075.851
202	Exh-27	0.04637	1.185933504	1.340005866	26653.94964	2730807.303

APPENDIX C - Compression Stroke Spreadsheet

	A	B	C	D	E	F	G	H
1								
2								
3	**#251 Havoline SAE30 Motored 1000 rpm**							
4	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
5	Comp-2	0.202081	10.698	0.097098	0.16057	11.697	0.104983	0.999
6	Comp-4	0.26468	10.608	0.079138	0.17923	11.812	0.185542	1.204
7	Comp-6	0.25499	10.602	0.079211	0.15245	11.678	0.175779	1.076
8	Comp-8	0.20935	10.659	0.07996	0.18982	11.671	0.12939	1.012
9	Comp-10	0.21431	10.621	0.082474	0.18013	11.746	0.131836	1.125
10	Comp-12	0.23754	10.659	0.083731	0.16674	11.69	0.153809	1.031
11	Comp-14	0.23582	10.514	0.089339	0.20653	11.697	0.146481	1.183
12								
13	**#252 Havoline SAE30 Motored 1500 rpm**							
14	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
15	Comp-2	0.15564	10.64	0.075077	0.141	11.822	0.080563	1.182
16	Comp-6	0.14271	10.785	0.069469	0.12074	11.649	0.073241	0.864
17	Comp-8	0.20043	10.64	0.080806	0.11254	11.778	0.119624	1.138
18	Comp-10	0.17926	10.814	0.098686	0.13531	11.793	0.080574	0.979
19	Comp-12	0.17807	10.611	0.097509	0.1146	11.793	0.080561	1.182
20	Comp-14	0.15473	10.785	0.071717	0.11566	11.851	0.083013	1.066
21	Comp-16	0.15692	10.698	0.088565	0.13251	11.778	0.068355	1.08
22	Comp-18	0.17343	10.272	0.090427	0.11972	11.613	0.083003	1.341
23	Comp-20	0.18349	10.785	0.10537	0.13222	11.806	0.07812	1.021
24	Comp-22	0.17747	10.703	0.089581	0.10911	11.793	0.087889	1.09
25								
26	**#253 Havoline SAE30 Motored 2000 rpm**							
27	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
28	Comp-6	0.12589	10.664	0.094149	0.11124	11.527	0.031741	0.863
29	Comp-8	0.12456	10.776	0.073288	0.09282	11.725	0.051272	0.949
30	Comp-12	0.14334	10.739	0.10184	0.1409	11.567	0.0415	0.828
31	Comp-14	0.11907	10.776	0.09954	0.097098	11.671	0.01953	0.895
32	Comp-16	0.15557	10.734	0.11407	0.123836	11.709	0.0415	0.975
33	Comp-18	0.13222	10.701	0.085834	0.10292	11.646	0.046386	0.945
34	Comp-20	0.14772	10.851	0.1266	0.13063	11.725	0.02112	0.874
35	Comp-24	0.11837	10.655	0.079307	0.10372	11.709	0.039063	1.054
36	Comp-28	0.13742	10.694	0.10568	0.113	11.709	0.03174	1.015
37								
38	**#254 Havoline SAE30 Motored 2500 rpm**							
39	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
40	Comp-2	0.16872	10.618	0.08083	0.09792	11.691	0.08789	1.073
41	Comp-4	0.17447	10.541	0.10611	0.11832	11.719	0.06836	1.178
42	Comp-6	0.18286	10.723	0.094971	0.11694	11.789	0.087889	1.066
43	Comp-8	0.14969	10.618	0.083513	0.10793	11.643	0.066177	1.025
44	Comp-10	0.13096	10.587	0.084577	0.11632	11.789	0.046383	1.202
45	Comp-12	0.14373	10.765	0.099781	0.14373	11.691	0.043949	0.926
46	Comp-16	0.15717	10.677	0.086636	0.12299	11.719	0.070534	1.042
47	Comp-18	0.13751	10.765	0.091128	0.11066	11.81	0.046382	1.045
48	Comp-20	0.12487	10.618	0.088251	0.11022	11.719	0.036619	1.101
49	Comp-22	0.16057	10.667	0.10442	0.15325	11.691	0.05615	1.024
50	Comp-26	0.13282	10.667	0.093762	0.11818	11.674	0.039058	1.007
51	Comp-30	0.17571	10.765	0.10246	0.13664	11.691	0.07325	0.926
52	Comp-32	0.13867	10.677	0.096566	0.14295	11.764	0.042104	1.087
53	Comp-34	0.14196	10.723	0.1029	0.13708	11.643	0.03906	0.92
54								
55	**#301 MOBIL 1 Motored 1000 RPM**							
56	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
57	Comp-2	0.27549	10.691	0.12168	0.20225	11.868	0.15381	1.177
58	Comp-4	0.30624	10.729	0.13046	0.16463	11.715	0.17578	0.986
59	Comp-6	0.2802	10.71	0.10931	0.15813	11.849	0.17089	1.139
60	Comp-8	0.25076	10.679	0.10428	0.16775	11.686	0.14648	1.007
61	Comp-10	0.26152	10.641	0.11992	0.16386	11.868	0.1416	1.227
62	Comp-12	0.27334	10.729	0.12197	0.1708	11.887	0.15137	1.158
63	Comp-14	0.25818	10.621	0.12391	0.1825	11.845	0.13427	1.224
64								
65	**#302 Mobil 1 Motored 1500 rpm**							
66	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
67	Comp-2	0.23089	10.881	0.13324	0.1723	11.792	0.09765	0.911
68	Comp-4	0.23137	10.554	0.10686	0.17766	11.899	0.12451	1.345
69	Comp-6	0.24266	10.583	0.12304	0.19383	11.734	0.11962	1.151
70	Comp-8	0.20534	10.633	0.12479	0.17849	11.792	0.08055	1.159
71	Comp-10	0.2168	10.641	0.12158	0.20947	11.789	0.09522	1.148
72	Comp-12	0.19645	10.612	0.10856	0.16471	11.763	0.08789	1.151
73	Comp-14	0.22052	10.554	0.12042	0.16925	11.816	0.1001	1.262

	A	B	C	D	E	F	G	H
74	Comp-16	0.20851	10.641	0.11574	0.18653	11.763	0.09277	1.122
75	Comp-18	0.20285	10.743	0.13938	0.18332	11.734	0.06347	0.991
76	Comp-20	0.21902	10.641	0.10916	0.17996	11.792	0.10986	1.151
77	Comp-22	0.23756	10.578	0.11793	0.15455	11.792	0.11963	1.214
78								
79	#303 Mobil 1 Motored 2000 rpm							
80	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
81	Comp-2	0.19867	10.579	0.10101	0.14496	11.734	0.09766	1.155
82	Comp-4	0.20213	10.542	0.124	0.16795	11.734	0.07813	1.192
83	Comp-6	0.21537	10.579	0.12748	0.17631	11.774	0.08789	1.195
84	Comp-8	0.18071	10.507	0.10503	0.15874	11.813	0.07568	1.306
85	Comp-10	0.20708	10.617	0.12896	0.15581	11.695	0.07812	1.078
86	Comp-12	0.20121	10.542	0.12552	0.15726	11.66	0.07569	1.118
87	Comp-14	0.22449	10.542	0.12195	0.19763	11.734	0.10254	1.192
88	Comp-16	0.17198	10.579	0.10607	0.19396	11.734	0.06591	1.155
89	Comp-18	0.1985	10.617	0.10573	0.157	11.771	0.09277	1.154
90	Comp-20	0.19959	10.542	0.11902	0.15808	11.774	0.08057	1.232
91	Comp-22	0.18131	10.579	0.1154	0.15934	11.655	0.06591	1.076
92	Comp-26	0.19734	10.542	0.1189	0.17293	11.734	0.07844	1.192
93	Comp-28	0.18523	10.542	0.10466	0.15349	11.808	0.08057	1.266
94								
95	#304 Mobil 1 Motored 2500 rpm							
96	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
97	Comp-1	0.14909	10.712	0.11247	0.15886	11.824	0.03662	1.112
98	Comp-3	0.16945	10.694	0.10353	0.14991	11.869	0.06592	1.175
99	Comp-5	0.15871	10.739	0.11477	0.13918	11.831	0.04394	1.092
100	Comp-7	0.17725	10.712	0.12354	0.15772	11.689	0.05371	0.977
101	Comp-11	0.15801	10.694	0.10674	0.15313	11.734	0.05127	1.04
102	Comp-13	0.15221	10.712	0.11803	0.13756	11.779	0.03418	1.067
103	Comp-17	0.14607	10.516	0.10701	0.14119	11.689	0.03906	1.173
104	Comp-19	0.162551	10.513	0.11368	0.14298	11.734	0.048871	1.221
105	Comp-21	0.16118	10.649	0.10503	0.13677	11.734	0.05615	1.085
108	Comp-23	0.14772	10.614	0.11354	0.13795	11.831	0.03418	1.217
107	Comp-25	0.15516	10.76	0.12586	0.15272	11.831	0.0293	1.071
108	Comp-27	0.15231	10.663	0.11325	0.15231	11.734	0.03906	1.071
109	Comp-29	0.15342	10.663	0.12901	0.16563	11.689	0.02441	1.026
110	Comp-31	0.1531	10.649	0.10428	0.1531	11.739	0.04882	1.09
111								
112	#352 Pennzoil 15W40 Motored 1500 rpm							
113	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
114	Comp-2	0.19115	10.272	0.10814	0.14232	11.541	0.08301	1.269
115	Comp-4	0.16309	10.358	0.11914	0.15088	11.486	0.04395	1.128
116	Comp-6	0.19151	10.358	0.14757	0.21105	11.445	0.04394	1.087
117	Comp-8	0.16855	10.3	0.12216	0.16123	11.388	0.04639	1.088
118	Comp-10	0.17948	10.358	0.12821	0.16483	11.474	0.05127	1.116
119	Comp-12	0.17167	10.358	0.11063	0.17899	11.35	0.06104	0.992
120	Comp-16	0.19603	10.3	0.11791	0.13744	11.474	0.07812	1.174
121	Comp-18	0.19603	10.329	0.11791	0.13012	11.388	0.07812	1.059
122	Comp-22	0.14798	10.329	0.10159	0.1553	11.445	0.04639	1.116
123								
124	#353 Pennzoil 15W40 Motored 2000 rpm							
125	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
126	Comp-6	0.17675	10.343	0.11571	0.1328	11.353	0.06104	1.01
127	Comp-8	0.15163	10.422	0.10524	0.14919	11.427	0.04639	1.005
128	Comp-10	0.16625	10.353	0.08813	0.11987	11.39	0.07812	1.037
129	Comp-12	0.17116	10.383	0.095479	0.12233	11.39	0.075681	1.007
130	Comp-14	0.17459	10.278	0.12333	0.18924	11.427	0.05126	1.149
131	Comp-16	0.16333	10.353	0.1145	0.13403	11.427	0.04883	1.074
132	Comp-18	0.14619	10.278	0.11201	0.15107	11.427	0.03418	1.149
133	Comp-20	0.17116	10.353	0.11745	0.11989	11.445	0.05371	1.092
134	Comp-22	0.13367	10.343	0.084843	0.11658	11.464	0.048827	1.121
135	Comp-24	0.1458	10.278	0.10674	0.11651	11.353	0.03906	1.075
136	Comp-26	0.16633	10.315	0.11994	0.14191	11.39	0.04639	1.075
137	Comp-28	0.1474	10.278	0.11078	0.15228	11.427	0.03662	1.149
138								
139	#354 Pennzoil 15W40 Motored 2500 rpm							
140	Stroke/rev	Inlet (volts)	Inlet (mm)	h min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
141	Comp-2	0.1291	10.456	0.092481	0.10957	11.421	0.036619	0.965
142	Comp-4	0.141015	10.321	0.10109	0.12062	11.445	0.039925	1.124
143	Comp-8	0.14119	10.456	0.11677	0.14363	11.518	0.02442	1.062
144	Comp-10	0.13239	10.456	0.11286	0.13239	11.445	0.01953	0.989
145	Comp-12	0.12301	10.355	0.098597	0.14254	11.373	0.024413	1.018
146	Comp-18	0.13282	10.404	0.11085	0.15236	11.421	0.02197	1.017

	A	B	C	D	E	F	G	H
147	Comp-20	0.13321	10.355	0.11368	0.14542	11.445	0.01953	1.09
148	Comp-26	0.12195	10.453	0.09265	0.12927	11.421	0.0293	0.968
149	Comp-32	0.13418	10.321	0.097357	0.13174	11.566	0.036623	1.245
150								
151	#401 Pennzoil SAE30 Motored 1000 rpm							
152	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
153	Comp-2	0.18666	10.524	0.1305	0.19388	11.613	0.05616	1.089
154	Comp-4	0.17537	10.448	0.11433	0.20466	11.613	0.06104	1.165
155	Comp-6	0.18719	10.543	0.12615	0.17498	11.609	0.06104	1.066
156	Comp-8	0.18886	10.62	0.12538	0.17421	11.632	0.06348	1.012
157	Comp-10	0.18397	10.563	0.12538	0.16688	11.494	0.05859	0.931
158	Comp-12	0.20889	10.448	0.13807	0.18692	11.632	0.07082	1.184
159	Comp-14	0.19333	10.563	0.12985	0.186	11.651	0.06348	1.088
160								
161	#402 Pennzoil SAE30 Motored 1500 rpm							
162	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	b (mm)
163	Comp-1	0.22127	10.332	0.12117	0.16268	11.48	0.1001	1.148
164	Comp-3	0.22195	10.448	0.11697	0.15847	11.589	0.10498	1.141
165	Comp-5	0.23693	10.39	0.11975	0.15881	11.68	0.11718	1.29
166	Comp-7	0.2233	10.361	0.10367	0.15494	11.451	0.11963	1.09
167	Comp-9	0.23884	10.332	0.11433	0.13875	11.623	0.12451	1.291
168	Comp-11	0.25381	10.419	0.13174	0.15371	11.671	0.12207	1.252
169	Comp-13	0.25516	10.419	0.10379	0.17459	11.566	0.15137	1.147
170	Comp-15	0.21859	10.419	0.11605	0.17708	11.617	0.10254	1.198
171	Comp-17	0.21946	10.41	0.094947	0.16331	11.623	0.124513	1.213
172	Comp-19	0.21201	10.304	0.10703	0.15098	11.698	0.10498	1.394
173	Comp-21	0.25356	10.448	0.1315	0.15591	11.566	0.12206	1.118
174								
175	#403 Pennzoil SAE30 Motored 2000 rpm							
176	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	B (mm)
177	Comp-1	0.22596	10.366	0.12098	0.17713	11.554	0.10498	1.188
179	Comp-3	0.21936	10.415	0.10462	0.14368	11.554	0.11474	1.139
179	Comp-5	0.21851	10.255	0.13307	0.17213	11.441	0.08544	1.186
180	Comp-7	0.22519	10.336	0.11777	0.15194	11.517	0.10742	1.181
181	Comp-9	0.23486	10.329	0.12988	0.16161	11.554	0.10498	1.225
182	Comp-11	0.22816	10.329	0.14027	0.16712	11.554	0.08789	1.225
183	Comp-13	0.20841	10.336	0.13029	0.16935	11.554	0.07812	1.218
184	Comp-15	0.18726	10.441	0.11402	0.14331	11.519	0.07324	1.078
185	Comp-17	0.19463	10.415	0.12627	0.16045	11.48	0.06836	1.065
186	Comp-19	0.23957	10.366	0.13215	0.17853	11.48	0.10742	1.114
187	Comp-21	0.22886	10.441	0.13365	0.1605	11.628	0.09521	1.187
189	Comp-23	0.19582	10.441	0.13996	0.21291	11.519	0.05586	1.078
189	Comp-25	0.23224	10.441	0.11994	0.15168	11.517	0.1123	1.076
190								
191	#404 Pennzoil SAE30 Motored 2500 rpm							
192	Stroke/Rev	Inlet (volts)	Inlet (mm)	H min (volts)	Outlet (volts)	Outlet (mm)	Delta (volts)	B (mm)
193	Comp-2	0.17907	10.461	0.12536	0.14245	11.577	0.05371	1.116
194	Comp-4	0.17788	10.443	0.15591	0.18276	11.528	0.02197	1.085
195	Comp-6	0.15417	10.461	0.11999	0.15661	11.57	0.03418	1.109
196	Comp-10	0.16727	10.489	0.13553	0.17704	11.431	0.03174	0.942
197	Comp-12	0.1831	10.461	0.14892	0.17578	11.525	0.03418	1.064
198	Comp-20	0.16132	10.534	0.13935	0.16865	11.48	0.02197	0.946
199	Comp-22	0.1672	10.489	0.13302	0.16231	11.48	0.03418	0.991
200	Comp-26	0.16998	10.469	0.13336	0.18218	11.435	0.03662	0.966
201	Comp-30	0.16857	10.558	0.13928	0.16125	11.525	0.02929	0.967
202	Comp-32	0.16628	10.461	0.12478	0.18093	11.525	0.0415	1.064

	I	J	K	L	M	N	O	P
1								
2								
3	#251 Havoline SAE30 Motored 1000 rpm							
4	Stroke/Rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
5	Comp-2	35.6	2.948960674	2.72747191	511110	73	17.10375498	0.017103755
6	Comp-4	35.6	5.211853933	2.222977528	511110	73	17.10375498	0.017103755
7	Comp-6	35.6	4.93761236	2.22502809	511110	73	17.10375498	0.017103755
8	Comp-8	35.6	3.634550562	2.246067416	511110	73	17.10375498	0.017103755
9	Comp-10	35.6	3.703258427	2.316685393	511110	73	17.10375498	0.017103755
10	Comp-12	35.6	4.320477528	2.351994382	511110	73	17.10375498	0.017103755
11	Comp-14	35.6	4.114634831	2.509522472	511110	73	17.10375498	0.017103755
12								
13	#252 Havoline SAE30 Motored 1500 rpm							
14	Stroke/Rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
15	Comp-2	35.6	2.263005618	2.108904494	511111	83.3	12.5655416	0.012565542
16	Comp-6	35.6	2.057331461	1.951376404	511111	83.3	12.5655416	0.012565542
17	Comp-8	35.6	3.360224719	2.269831461	511111	83.3	12.5655416	0.012565542
18	Comp-10	35.6	2.263314607	2.772078652	511111	83.3	12.5655416	0.012565542
19	Comp-12	35.6	2.262949438	2.739016854	511111	83.3	12.5655416	0.012565542
20	Comp-14	35.6	2.331825843	2.014522472	511111	83.3	12.5655416	0.012565542
21	Comp-16	35.6	1.92008427	2.487780899	511111	83.3	12.5655416	0.012565542
22	Comp-18	35.6	2.331544944	2.54008427	511111	83.3	12.5655416	0.012565542
23	Comp-20	35.6	2.194382022	2.959831461	511111	83.3	12.5655416	0.012565542
24	Comp-22	35.6	2.468792135	2.516320225	511111	83.3	12.5655416	0.012565542
25								
26	#253 Havoline SAE30 Motored 2000 rpm							
27	Stroke/Rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
28	Comp-6	35.6	0.891601124	2.644634831	470542	92.7	9.788249549	0.00978825
29	Comp-8	35.6	1.440224719	2.058651685	470542	92.7	9.788249549	0.00978825
30	Comp-12	35.6	1.165730337	2.860674157	470542	92.7	9.788249549	0.00978825
31	Comp-14	35.6	0.548595506	2.796067416	470542	92.7	9.788249549	0.00978825
32	Comp-16	35.6	1.165730337	3.204213483	470542	92.7	9.788249549	0.00978825
33	Comp-18	35.6	1.302977528	2.411067416	470542	92.7	9.788249549	0.00978825
34	Comp-20	35.6	0.593258427	3.556179775	470542	92.7	9.788249549	0.00978825
35	Comp-24	35.6	1.097275281	2.227724719	470542	92.7	9.788249549	0.00978825
36	Comp-28	35.6	0.891573034	2.968539326	470542	92.7	9.788249549	0.00978825
37								
38	#254 Havoline SAE30 Motored 2500 rpm							
39	Stroke/Rev	Cal (mV/μm)	Delta (μm)	h min (μm)	W (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
40	Comp-2	35.6	2.468820225	2.270505618	470426	101.3	7.956018324	0.007956018
41	Comp-4	35.6	1.920224719	2.980617978	470426	101.3	7.956018324	0.007956018
42	Comp-6	35.6	2.468792135	2.667724719	470426	101.3	7.956018324	0.007956018
43	Comp-8	35.6	1.858904494	2.345870787	470426	101.3	7.956018324	0.007956018
44	Comp-10	35.6	1.302893258	2.375758427	470426	101.3	7.956018324	0.007956018
45	Comp-12	35.6	1.234522472	2.802837079	470426	101.3	7.956018324	0.007956018
46	Comp-16	35.6	1.981292135	2.433595506	470426	101.3	7.956018324	0.007956018
47	Comp-18	35.6	1.302865169	2.559775281	470426	101.3	7.956018324	0.007956018
48	Comp-20	35.6	1.028623596	2.478960674	470426	101.3	7.956018324	0.007956018
49	Comp-22	35.6	1.577247191	2.933146067	470426	101.3	7.956018324	0.007956018
50	Comp-26	35.6	1.097134831	2.633764045	470426	101.3	7.956018324	0.007956018
51	Comp-30	35.6	2.05758427	2.878089888	470426	101.3	7.956018324	0.007956018
52	Comp-32	35.6	1.182696629	2.71252809	470426	101.3	7.956018324	0.007956018
53	Comp-34	35.6	1.097191011	2.890449438	470426	101.3	7.956018324	0.007956018
54								
55	#301 Mobil 1 Motored 1000 rpm							
56	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
57	Comp-2	33.8	4.550591716	3.6	511110	73	20.98534438	0.020985344
58	Comp-4	33.8	5.200591716	3.859763314	511110	73	20.98534438	0.020985344
59	Comp-6	33.8	5.05591716	3.234023669	511110	73	20.98534438	0.020985344
60	Comp-8	33.8	4.333727811	3.085207101	511110	73	20.98534438	0.020985344
61	Comp-10	33.8	4.189349112	3.547928994	511110	73	20.98534438	0.020985344
62	Comp-12	33.8	4.478402367	3.608579882	511110	73	20.98534438	0.020985344
63	Comp-14	33.8	3.972485207	3.665976331	511110	73	20.98534438	0.020985344
64								
65	#302 Mobil 1 Motored 1500 rpm							
66	Stroke/rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa-s)
67	Comp-2	33.8	2.889053254	3.942011834	511111	83.3	15.88381858	0.015883819
68	Comp-4	33.8	3.683727811	3.161538462	511111	83.3	15.88381858	0.015883819
69	Comp-6	33.8	3.539053254	3.640236686	511111	83.3	15.88381858	0.015883819
70	Comp-8	33.8	2.383136095	3.692011834	511111	83.3	15.88381858	0.015883819
71	Comp-10	33.8	2.817159763	3.59704142	511111	83.3	15.88381858	0.015883819
72	Comp-12	33.8	2.600295858	3.21183432	511111	83.3	15.88381858	0.015883819
73	Comp-14	33.8	2.961538462	3.562721893	511111	83.3	15.88381858	0.015883819

	I	J	K	L	M	N	O	P
74	Comp-16	33.8	2.744674556	3.424260355	511111	83.3	15.88381858	0.015883819
75	Comp-18	33.8	1.877810651	4.123668639	511111	83.3	15.88381858	0.015883819
76	Comp-20	33.8	3.250295858	3.229585799	511111	83.3	15.88381858	0.015883819
77	Comp-22	33.8	3.539349112	3.489053254	511111	83.3	15.88381858	0.015883819
78								
79	#303 Mobil 1 Motored 2000 rpm							
80	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
81	Comp-2	33.8	2.889349112	2.988461538	470542	92.7	12.67559472	0.012675595
82	Comp-4	33.8	2.311538462	3.668639053	470542	92.7	12.67559472	0.012675595
83	Comp-6	33.8	2.600295858	3.771597633	470542	92.7	12.67559472	0.012675595
84	Comp-8	33.8	2.239053254	3.10739645	470542	92.7	12.67559472	0.012675595
85	Comp-10	33.8	2.311242604	3.815384615	470542	92.7	12.67559472	0.012675595
86	Comp-12	33.8	2.239349112	3.713609467	470542	92.7	12.67559472	0.012675595
87	Comp-14	33.8	3.033727811	3.607988166	470542	92.7	12.67559472	0.012675595
88	Comp-16	33.8	1.95	3.13816568	470542	92.7	12.67559472	0.012675595
89	Comp-18	33.8	2.744674556	3.128106509	470542	92.7	12.67559472	0.012675595
90	Comp-20	33.8	2.383727811	3.521301775	470542	92.7	12.67559472	0.012675595
91	Comp-22	33.8	1.95	3.414201183	470542	92.7	12.67559472	0.012675595
92	Comp-26	33.8	2.320710059	3.517751479	470542	92.7	12.67559472	0.012675595
93	Comp-28	33.8	2.383727811	3.096449704	470542	92.7	12.67559472	0.012675595
94								
95	#304 Mobil 1 Motored 2500 rpm							
96	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
97	Comp-1	33.8	1.083431953	3.327514793	470426	101.3	10.51145773	0.010511458
98	Comp-3	33.8	1.950295858	3.063017751	470426	101.3	10.51145773	0.010511458
99	Comp-5	33.8	1.3	3.39556213	470426	101.3	10.51145773	0.010511458
100	Comp-7	33.8	1.589053254	3.655029586	470426	101.3	10.51145773	0.010511458
101	Comp-11	33.8	1.516863905	3.157988166	470426	101.3	10.51145773	0.010511458
102	Comp-13	33.8	1.011242604	3.492011834	470426	101.3	10.51145773	0.010511458
103	Comp-17	33.8	1.155621302	3.165976331	470426	101.3	10.51145773	0.010511458
104	Comp-19	33.8	1.445887574	3.363313609	470426	101.3	10.51145773	0.010511458
105	Comp-21	33.8	1.661242604	3.10739645	470426	101.3	10.51145773	0.010511458
106	Comp-23	33.8	1.011242604	3.359171598	470426	101.3	10.51145773	0.010511458
107	Comp-25	33.8	0.866863905	3.723668639	470426	101.3	10.51145773	0.010511458
108	Comp-27	33.8	1.155621302	3.350591716	470426	101.3	10.51145773	0.010511458
109	Comp-29	33.8	0.722189349	3.816863905	470426	101.3	10.51145773	0.010511458
110	Comp-31	33.8	1.444378698	3.085207101	470426	101.3	10.51145773	0.010511458
111								
112	#352 Pennzoil 15W40 Motored 1500 rpm							
113	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (C)	µ (CP)	µ (Pa-s)
114	Comp-2	31.9	2.602194357	3.389968652	511111	73	16.78137129	0.016781371
115	Comp-4	31.9	1.377742947	3.734796238	511111	73	16.78137129	0.016781371
116	Comp-6	31.9	1.377429467	4.626018809	511111	73	16.78137129	0.016781371
117	Comp-8	31.9	1.454231975	3.829467085	511111	73	16.78137129	0.016781371
118	Comp-10	31.9	1.607210031	4.019122257	511111	73	16.78137129	0.016781371
119	Comp-12	31.9	1.913479624	3.468025078	511111	73	16.78137129	0.016781371
120	Comp-16	31.9	2.448902821	3.696238245	511111	73	16.78137129	0.016781371
121	Comp-18	31.9	2.448902821	3.696238245	511111	73	16.78137129	0.016781371
122	Comp-22	31.9	1.454231975	3.184639498	511111	73	16.78137129	0.016781371
123								
124	#352 Pennzoil 15W40 Motored 2000 rpm							
125	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
126	Comp-6	31.9	1.913479624	3.627272727	470542	83.3	12.86091126	0.012860911
127	Comp-8	31.9	1.454231975	3.299059561	470542	83.3	12.86091126	0.012860911
128	Comp-10	31.9	2.448902821	2.762695925	470542	83.3	12.86091126	0.012860911
129	Comp-12	31.9	2.372445141	2.9930721	470542	83.3	12.86091126	0.012860911
130	Comp-14	31.9	1.606896552	3.866144201	470542	83.3	12.86091126	0.012860911
131	Comp-16	31.9	1.530721003	3.589341693	470542	83.3	12.86091126	0.012860911
132	Comp-18	31.9	1.071473354	3.511285266	470542	83.3	12.86091126	0.012860911
133	Comp-20	31.9	1.68369906	3.681818182	470542	83.3	12.86091126	0.012860911
134	Comp-22	31.9	1.530626959	2.659655172	470542	83.3	12.86091126	0.012860911
135	Comp-24	31.9	1.224451411	3.346081505	470542	83.3	12.86091126	0.012860911
136	Comp-26	31.9	1.454231975	3.759874608	470542	83.3	12.86091126	0.012860911
137	Comp-28	31.9	1.147962382	3.472727273	470542	83.3	12.86091126	0.012860911
138								
139	#352 Pennzoil 15W40 Motored 2500 rpm							
140	Stroke/rev	Cal (mV/µm)	Delta (µm)	h min (µm)	ΔP (Pa)	Oil Temp (°C)	µ (CP)	µ (Pa-s)
141	Comp-2	31.9	1.147931034	2.899090909	470426	101.3	8.669457444	0.008669457
142	Comp-4	31.9	1.251567398	3.168965517	470426	101.3	8.669457444	0.008669457
143	Comp-8	31.9	0.765517241	3.660501567	470426	101.3	8.669457444	0.008669457
144	Comp-10	31.9	0.612225705	3.537931034	470426	101.3	8.669457444	0.008669457
145	Comp-12	31.9	0.765297806	3.090815047	470426	101.3	8.669457444	0.008669457
146	Comp-18	31.9	0.688714734	3.47492163	470426	101.3	8.669457444	0.008669457

	I	J	K	L	M	N	O	P
147	Comp-20	31.9	0.612225705	3.563636364	470426	101.3	8.669457444	0.008669457
148	Comp-26	31.9	0.918495298	2.904388715	470426	101.3	8.669457444	0.008669457
149	Comp-32	31.9	1.148056426	3.058213166	470426	101.3	8.669457444	0.008669457
150								
151	#401 Pennzoil SAE30 Motored 1000 rpm							
152	Stroke/Rev	Cal (mV/μm)	Delta (μm)	h min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa•s)
153	Comp-2	31.9	1.760501567	4.090909091	511110	73	17.19084034	0.01719084
154	Comp-4	31.9	1.913479624	3.584012539	511110	73	17.19084034	0.01719084
155	Comp-6	31.9	1.913479624	3.954545455	511110	73	17.19084034	0.01719084
156	Comp-8	31.9	1.989968652	3.930407524	511110	73	17.19084034	0.01719084
157	Comp-10	31.9	1.836677116	3.930407524	511110	73	17.19084034	0.01719084
158	Comp-12	31.9	2.220062696	4.328213166	511110	73	17.19084034	0.01719084
159	Comp-14	31.9	1.989968652	4.070532915	511110	73	17.19084034	0.01719084
160								
161	#402 Pennzoil SAE30 Motored 1500 rpm							
162	Stroke/Rev	Cal (mV/μm)	Delta (μm)	H min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa•s)
163	Comp-1	31.9	3.137931034	3.798432602	511111	83.3	12.79394332	0.012793943
164	Comp-3	31.9	3.290909091	3.66677116	511111	83.3	12.79394332	0.012793943
165	Comp-5	31.9	3.673354232	3.753918495	511111	83.3	12.79394332	0.012793943
166	Comp-7	31.9	3.75015674	3.24984326	511111	83.3	12.79394332	0.012793943
167	Comp-9	31.9	3.903134796	3.584012539	511111	83.3	12.79394332	0.012793943
168	Comp-11	31.9	3.826645768	4.129780564	511111	83.3	12.79394332	0.012793943
169	Comp-13	31.9	4.745141066	3.253605016	511111	83.3	12.79394332	0.012793943
170	Comp-15	31.9	3.214420063	3.637931034	511111	83.3	12.79394332	0.012793943
171	Comp-17	31.9	3.90322884	2.976394984	511111	83.3	12.79394332	0.012793943
172	Comp-19	31.9	3.290909091	3.355172414	511111	83.3	12.79394332	0.012793943
173	Comp-21	31.9	3.826332288	4.122257053	511111	83.3	12.79394332	0.012793943
174								
175	#403 Pennzoil SAE30 Motored 2000 rpm							
176	Stroke/Rev	Cal (mV/μm)	Delta (μm)	H min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa•s)
177	Comp-1	31.9	3.290909091	3.792476489	470542	92.7	10.07114496	0.010071145
178	Comp-3	31.9	3.596865204	3.279623824	470542	92.7	10.07114496	0.010071145
179	Comp-5	31.9	2.678369906	4.171473354	470542	92.7	10.07114496	0.010071145
180	Comp-7	31.9	3.367398119	3.69184953	470542	92.7	10.07114496	0.010071145
181	Comp-9	31.9	3.290909091	4.071473354	470542	92.7	10.07114496	0.010071145
182	Comp-11	31.9	2.755172414	4.397178683	470542	92.7	10.07114496	0.010071145
183	Comp-13	31.9	2.448902821	4.084326019	470542	92.7	10.07114496	0.010071145
184	Comp-15	31.9	2.295924765	3.574294671	470542	92.7	10.07114496	0.010071145
185	Comp-17	31.9	2.142946708	3.95830721	470542	92.7	10.07114496	0.010071145
186	Comp-19	31.9	3.367398119	4.142633229	470542	92.7	10.07114496	0.010071145
187	Comp-21	31.9	2.984639498	4.189655172	470542	92.7	10.07114496	0.010071145
188	Comp-23	31.9	1.751097179	4.387460815	470542	92.7	10.07114496	0.010071145
189	Comp-25	31.9	3.520376176	3.759874608	470542	92.7	10.07114496	0.010071145
190								
191	#404 Pennzoil SAE30 Motored 2500 rpm							
192	Stroke/Rev	Cal (mV/μm)	Delta (μm)	H min (μm)	ΔP (Pa)	Oil Temp (°C)	μ (CP)	μ (Pa•s)
193	Comp-2	31.9	1.68369906	3.929780564	470426	101.3	8.2574414	0.009760465
194	Comp-4	31.9	0.688714734	4.887460815	470426	101.3	8.2574414	0.009760465
195	Comp-6	31.9	1.071473354	3.761442006	470426	101.3	8.2574414	0.009760465
196	Comp-10	31.9	0.994984326	4.248589342	470426	101.3	8.2574414	0.009760465
197	Comp-12	31.9	1.071473354	4.668338558	470426	101.3	8.2574414	0.009760465
198	Comp-20	31.9	0.688714734	4.368338558	470426	101.3	8.2574414	0.009760465
199	Comp-22	31.9	1.071473354	4.169905956	470426	101.3	8.2574414	0.009760465
200	Comp-26	31.9	1.147962382	4.180564263	470426	101.3	8.2574414	0.009760465
201	Comp-30	31.9	0.918181818	4.366144201	470426	101.3	8.2574414	0.009760465
202	Comp-32	31.9	1.300940439	3.911598746	470426	101.3	8.2574414	0.009760465

	Q	R	S	T	U	V	W	X
1								
2								
3	#251 Havoline SAE30 Motored 1000 rpm							
4	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/Wb
5	Comp-2	863.838	3.81	0.00192	2509.850852	1305.906771	134156.0935	0.000765751
6	Comp-4	863.838	3.81	0.00192	2509.850852	1573.885638	293347.7955	0.00063537
7	Comp-6	863.838	3.81	0.00192	2509.850852	1406.562248	233858.7082	0.000710953
8	Comp-8	863.838	3.81	0.00192	2509.850852	1322.900553	203009.0739	0.000755915
9	Comp-10	863.838	3.81	0.00192	2509.850852	1470.615734	235814.727	0.000679987
10	Comp-12	863.838	3.81	0.00192	2509.850852	1347.737619	192151.9386	0.000741984
11	Comp-14	863.838	3.81	0.00192	2509.850852	1546.434145	222222.1327	0.000646649
12								
13	#252 Havoline SAE30 Motored 1500 rpm							
14	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	Wb/6μU	(b/h)^2	6μU/Wb
15	Comp-2	857.349	5.715	0.00192	2277.549157	1402.1162	314138.473	0.000713208
16	Comp-6	857.349	5.715	0.00192	2277.549157	1024.897121	196040.3126	0.000975708
17	Comp-8	857.349	5.715	0.00192	2277.549157	1349.922365	251360.6564	0.000740783
18	Comp-10	857.349	5.715	0.00192	2277.549157	1161.312825	124725.2224	0.000861094
19	Comp-12	857.349	5.715	0.00192	2277.549157	1402.1162	186228.2422	0.000713208
20	Comp-14	857.349	5.715	0.00192	2277.549157	1264.514271	280007.8306	0.000790817
21	Comp-16	857.349	5.715	0.00192	2277.549157	1281.121401	188461.7645	0.000780566
22	Comp-18	857.349	5.715	0.00192	2277.549157	1590.725739	278715.6182	0.000628644
23	Comp-20	857.349	5.715	0.00192	2277.549157	1211.134213	118991.9331	0.000825672
24	Comp-22	857.349	5.715	0.00192	2277.549157	1292.983636	187638.166	0.000773405
25								
28	#253 Havoline SAE30 Motored 2000 rpm							
27	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	Wb/6μU	(b/h)^2	6μU/Wb
28	Comp-6	851.427	7.62	0.00192	2018.777092	907.3982451	106485.424	0.001102052
29	Comp-8	851.427	7.62	0.00192	2018.777092	997.8226357	212503.7902	0.001002182
30	Comp-12	851.427	7.62	0.00192	2018.777092	870.597621	83776.82325	0.001148636
31	Comp-14	851.427	7.62	0.00192	2018.777092	941.04453	102459.1606	0.001062649
32	Comp-16	851.427	7.62	0.00192	2018.777092	1025.160242	92590.48186	0.000975457
33	Comp-18	851.427	7.62	0.00192	2018.777092	993.6168501	153618.9914	0.001006424
34	Comp-20	851.427	7.62	0.00192	2018.777092	918.9641555	60402.57453	0.001088182
35	Comp-24	851.427	7.62	0.00192	2018.777092	1108.224508	223850.5543	0.000902344
36	Comp-28	851.427	7.62	0.00192	2018.777092	1067.218098	116908.6031	0.000937016
37								
36	#254 Havoline SAE30 Motored 2500 rpm							
39	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	Wb/6μU	(b/h)^2	6μU/Wb
40	Comp-2	846.009	9.525	0.00192	1986.463255	1110.143267	223333.7109	0.000900785
41	Comp-4	846.009	9.525	0.00192	1986.463255	1218.777976	156198.8916	0.000820494
42	Comp-6	846.009	9.525	0.00192	1986.463255	1102.900953	159673.3303	0.0009067
43	Comp-8	846.009	9.525	0.00192	1986.463255	1060.481686	190914.7824	0.000942968
44	Comp-10	846.009	9.525	0.00192	1986.463255	1243.608767	255979.0238	0.000804111
45	Comp-12	846.009	9.525	0.00192	1986.463255	958.0546741	109150.6346	0.001043782
46	Comp-16	846.009	9.525	0.00192	1986.463255	1078.070162	183332.1572	0.000927583
47	Comp-18	846.009	9.525	0.00192	1986.463255	1081.174011	166639.0489	0.00092492
48	Comp-20	846.009	9.525	0.00192	1986.463255	1139.112523	197258.3352	0.000877876
49	Comp-22	846.009	9.525	0.00192	1986.463255	1059.447069	121880.0241	0.000943889
50	Comp-26	846.009	9.525	0.00192	1986.463255	1041.858593	146185.8078	0.000959823
51	Comp-30	846.009	9.525	0.00192	1986.463255	958.0546741	103517.3787	0.001043782
52	Comp-32	846.009	9.525	0.00192	1986.463255	1124.627895	160587.0794	0.000889183
53	Comp-34	846.009	9.525	0.00192	1986.463255	951.8469764	101308.2705	0.001050589
54								
55	#301 MOBIL 1 MOTORED 1000 RPM							
56	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
57	Comp-2	863.838	3.81	0.00192	2045.612082	1254.002823	106892.6698	0.000797446
58	Comp-4	863.838	3.81	0.00192	2045.612082	1050.507038	65257.80804	0.000951921
59	Comp-6	863.838	3.81	0.00192	2045.612082	1213.516751	124039.8008	0.000824051
60	Comp-8	863.838	3.81	0.00192	2045.612082	1072.88092	106534.5061	0.00093207
81	Comp-10	863.838	3.81	0.00192	2045.612082	1307.273971	119602.2325	0.000764951
82	Comp-12	863.838	3.81	0.00192	2045.612082	1233.759787	102978.0045	0.000810531
63	Comp-14	863.838	3.81	0.00192	2045.612082	1304.077703	111476.5507	0.000766825
64								
65	#302 Mobil 1 Motored 1500 rpm							
68	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
67	Comp-2	857.349	5.715	0.00192	1801.74802	854.8918989	53407.33488	0.001169739
88	Comp-4	857.349	5.715	0.00192	1801.74802	1262.162024	180987.1034	0.000792291
69	Comp-6	857.349	5.715	0.00192	1801.74802	1080.110401	99974.99772	0.000925831
70	Comp-8	857.349	5.715	0.00192	1801.74802	1087.617685	98546.38624	0.000919441
71	Comp-10	857.349	5.715	0.00192	1801.74802	1077.29517	101857.4733	0.000928251
72	Comp-12	857.349	5.715	0.00192	1801.74802	1080.110401	128423.4635	0.000925831
73	Comp-14	857.349	5.715	0.00192	1801.74802	1184.273959	125474.324	0.000844399

	Q	R	S	T	U	V	W	X
74	Comp-16	857.349	5.715	0.00192	1801.74802	1052.896499	107362.3869	0.000949761
75	Comp-18	857.349	5.715	0.00192	1801.74802	929.9647331	57753.69688	0.00107531
76	Comp-20	857.349	5.715	0.00192	1801.74802	1080.110401	127015.5794	0.000925831
77	Comp-22	857.349	5.715	0.00192	1801.74802	1139.230258	121065.9954	0.000877786
78								
79	#303 Mobil 1 Motored 2000 rpm							
80	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
81	Comp-2	851.427	7.62	0.00192	1558.924405	937.7904625	149371.8042	0.001066336
82	Comp-4	851.427	7.62	0.00192	1558.924405	967.8322349	105570.4909	0.001033237
83	Comp-6	851.427	7.62	0.00192	1558.924405	970.2680543	100388.7627	0.001030643
84	Comp-8	851.427	7.62	0.00192	1558.924405	1060.393371	176641.6137	0.000943046
85	Comp-10	851.427	7.62	0.00192	1558.924405	875.2710984	79829.03388	0.001142503
86	Comp-12	851.427	7.62	0.00192	1558.924405	907.7486901	90633.99982	0.001101626
87	Comp-14	851.427	7.62	0.00192	1558.924405	967.8322349	109149.6386	0.001033237
88	Comp-16	851.427	7.62	0.00192	1558.924405	937.7904625	135460.3618	0.001066336
89	Comp-18	851.427	7.62	0.00192	1558.924405	936.9785227	136097.0005	0.00106726
90	Comp-20	851.427	7.62	0.00192	1558.924405	1000.309827	122409.4437	0.00099969
91	Comp-22	851.427	7.62	0.00192	1558.924405	873.6472188	99322.19884	0.001144627
92	Comp-26	851.427	7.62	0.00192	1558.924405	967.8322349	114821.2319	0.001033237
93	Comp-28	851.427	7.62	0.00192	1558.924405	1027.91578	167162.6899	0.000972842
94								
95	#304 Mobil 1 Motored 2500 rpm							
96	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6μU/bΔP
97	Comp-1	846.009	9.525	0.00192	1503.534377	54.55881949	111678.5032	0.018328842
98	Comp-3	846.009	9.525	0.00192	1503.534377	57.64983175	147155.5702	0.017346104
99	Comp-5	846.009	9.525	0.00192	1503.534377	53.57754576	103424.139	0.018664535
100	Comp-7	846.009	9.525	0.00192	1503.534377	47.9352218	71450.8392	0.020861487
101	Comp-11	846.009	9.525	0.00192	1503.534377	51.02623406	108454.027	0.019597762
102	Comp-13	846.009	9.525	0.00192	1503.534377	52.35095359	93363.56472	0.019101849
103	Comp-17	846.009	9.525	0.00192	1503.534377	57.55170437	137271.6003	0.01737568
104	Comp-19	846.009	9.525	0.00192	1503.534377	59.90676133	131794.2912	0.016692607
105	Comp-21	846.009	9.525	0.00192	1503.534377	53.23409995	121917.5273	0.018784952
106	Comp-23	846.009	9.525	0.00192	1503.534377	59.71050658	131255.2783	0.016747471
107	Comp-25	846.009	9.525	0.00192	1503.534377	52.54720834	82725.02125	0.019030507
108	Comp-27	846.009	9.525	0.00192	1503.534377	52.54720834	102172.9472	0.019030507
109	Comp-29	846.009	9.525	0.00192	1503.534377	50.33934244	72257.24046	0.019865178
110	Comp-31	846.009	9.525	0.00192	1503.534377	53.47941839	124820.0498	0.018698782
111								
112	#352 PENNZOIL 15W-40 MOTORED 1500 RPM							
113	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6μU	(b/h)^2	6Uμ/ΔPb
114	Comp-2	863.838	5.715	0.00192	1705.381412	1127.150527	140130.2445	0.000586379
115	Comp-4	863.838	5.715	0.00192	1705.381412	1001.91158	91218.80403	0.000586379
116	Comp-6	863.838	5.715	0.00192	1705.381412	965.4945809	55213.37562	0.000586379
117	Comp-8	863.838	5.715	0.00192	1705.381412	966.3828004	80719.99173	0.000586379
118	Comp-10	863.838	5.715	0.00192	1705.381412	991.252946	77102.05527	0.000586379
119	Comp-12	863.838	5.715	0.00192	1705.381412	881.1137297	81819.88894	0.000586379
120	Comp-16	863.838	5.715	0.00192	1705.381412	1042.769676	100882.6034	0.000586379
121	Comp-18	863.838	5.715	0.00192	1705.381412	940.6244353	82086.55084	0.000586379
122	Comp-22	863.838	5.715	0.00192	1705.381412	991.252946	122802.6771	0.000586379
123								
124	#353 PENNZOIL 15W40 MOTORED 2000 RPM							
125	Stroke/rev	rho (kg/m3)	U (m/s)	b (m)	WB/6μU	ΔPb/6μU	(b/h)^2	6Uμ/Wb
126	Comp-6	857.349	7.62	0.00192	1536.461419	808.2427255	77532.23912	0.000650846
127	Comp-8	857.349	7.62	0.00192	1536.461419	804.2415239	92800.81938	0.000650846
128	Comp-10	857.349	7.62	0.00192	1536.461419	829.8492142	140893.6236	0.000650846
129	Comp-12	857.349	7.62	0.00192	1536.461419	805.8420045	113194.3067	0.000650846
130	Comp-14	857.349	7.62	0.00192	1536.461419	919.4761303	88325.06394	0.000650846
131	Comp-16	857.349	7.62	0.00192	1536.461419	859.4581061	89532.13801	0.000650846
132	Comp-18	857.349	7.62	0.00192	1536.461419	919.4761303	107079.8685	0.000650846
133	Comp-20	857.349	7.62	0.00192	1536.461419	873.8624319	87967.16598	0.000650846
134	Comp-22	857.349	7.62	0.00192	1536.461419	897.0694013	177648.0965	0.000650846
135	Comp-24	857.349	7.62	0.00192	1536.461419	860.2583464	103215.2569	0.000650846
136	Comp-26	857.349	7.62	0.00192	1536.461419	860.2583464	81746.69544	0.000650846
137	Comp-28	857.349	7.62	0.00192	1536.461419	919.4761303	109470.9033	0.000650846
138								
139	#354 PENNZOIL 15W40 MOTORED 2500 RPM							
140	Stroke/rev	rho (kg/m3)	U (m/s)	B (m)	WB/6μU	ΔPb/6μU	(b/h)^2	6Uμ/Wb
141	Comp-2	846.009	9.525	0.00192	1822.990442	916.242592	110797.7544	0.000548549
142	Comp-4	846.009	9.525	0.00192	1822.990442	1067.208988	125804.9112	0.000548549
143	Comp-8	846.009	9.525	0.00192	1822.990442	1008.341588	84172.03734	0.000548549
144	Comp-10	846.009	9.525	0.00192	1822.990442	939.0299725	78143.67963	0.000548549
145	Comp-12	846.009	9.525	0.00192	1822.990442	966.564724	108479.961	0.000548549
146	Comp-18	846.009	9.525	0.00192	1822.990442	965.6152498	85654.83386	0.000548549

	Q	R	S	T	U	V	W	X
147	Comp-20	846.009	9.525	0.00192	1822.990442	1034.926866	93554.83392	0.000548549
148	Comp-26	846.009	9.525	0.00192	1822.990442	919.0910145	111081.3715	0.000548549
149	Comp-32	846.009	9.525	0.00192	1822.990442	1182.095365	165730.7881	0.000548549
150								
151	#401 Pennzoil SAE30 Motored 1000 rpm							
152	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6Uμ	(b/h)^2	6μU/Wb
153	Comp-2	863.838	3.81	0.00192	2497.13645	1416.34458	70862.44	0.000400459
154	Comp-4	863.838	3.81	0.00192	2497.13645	1515.189565	105660.5361	0.000400459
155	Comp-6	863.838	3.81	0.00192	2497.13645	1386.430967	72664.32871	0.000400459
156	Comp-8	863.838	3.81	0.00192	2497.13645	1316.199004	66295.77626	0.000400459
157	Comp-10	863.838	3.81	0.00192	2497.13645	1210.85106	56107.92361	0.000400459
158	Comp-12	863.838	3.81	0.00192	2497.13645	1539.900811	74831.78783	0.000400459
159	Comp-14	863.838	3.81	0.00192	2497.13645	1415.043988	71442.27059	0.000400459
160								
161	#402 Pennzoil SAE30 Motored 1500 rpm							
162	Stroke/Rev	rho)kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6Uμ	(b/h)^2	6μU/Wb
163	Comp-1	857.349	5.715	0.00192	2236.889593	1337.473569	91342.9275	0.000447049
164	Comp-3	857.349	5.715	0.00192	2236.889593	1329.318243	96828.60502	0.000447049
165	Comp-5	857.349	5.715	0.00192	2236.889593	1502.910196	118089.0809	0.000447049
166	Comp-7	857.349	5.715	0.00192	2236.889593	1269.900863	112493.6906	0.000447049
167	Comp-9	857.349	5.715	0.00192	2236.889593	1504.075242	129751.8156	0.000447049
168	Comp-11	857.349	5.715	0.00192	2236.889593	1458.638422	91908.29418	0.000447049
169	Comp-13	857.349	5.715	0.00192	2236.889593	1336.308523	124278.8363	0.000447049
170	Comp-15	857.349	5.715	0.00192	2236.889593	1395.725903	108443.7963	0.000447049
171	Comp-17	857.349	5.715	0.00192	2236.889593	1413.201602	166088.8483	0.000447049
172	Comp-19	857.349	5.715	0.00192	2236.889593	1624.075049	172621.8882	0.000447049
173	Comp-21	857.349	5.715	0.00192	2236.889593	1302.522169	73555.21471	0.000447049
174								
175	#403 Pennzoil SAE30 Motored 2000 rpm							
176	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6Uμ	(b/h)^2	6μU/Wb
177	Comp-1	851.427	7.62	0.00192	1962.070256	1214.030971	98126.67589	0.000509666
178	Comp-3	851.427	7.62	0.00192	1962.070256	1163.957303	120614.4617	0.000509666
179	Comp-5	851.427	7.62	0.00192	1962.070256	1211.987147	80833.32257	0.000509666
180	Comp-7	851.427	7.62	0.00192	1962.070256	1206.87759	102332.0823	0.000509666
181	Comp-9	851.427	7.62	0.00192	1962.070256	1251.8417	90525.09382	0.000509666
182	Comp-11	851.427	7.62	0.00192	1962.070256	1251.8417	77611.11978	0.000509666
183	Comp-13	851.427	7.62	0.00192	1962.070256	1244.688318	88931.1226	0.000509666
184	Comp-15	851.427	7.62	0.00192	1962.070256	1101.620696	90961.33265	0.000509666
185	Comp-17	851.427	7.62	0.00192	1962.070256	1088.335845	72390.27405	0.000509666
186	Comp-19	851.427	7.62	0.00192	1962.070256	1138.409513	72313.17211	0.000509666
187	Comp-21	851.427	7.62	0.00192	1962.070256	1213.009059	80268.4502	0.000509666
188	Comp-23	851.427	7.62	0.00192	1962.070256	1101.620696	60368.58831	0.000509666
189	Comp-25	851.427	7.62	0.00192	1962.070256	1099.576872	81898.85306	0.000509666
190								
181	#404 Pennzoil SAE30 Motored 2500 rpm							
192	Stroke/Rev	rho (kg/m3)	U (m/s)	B (m)	ΔPB/6μU	ΔPb/6Uμ	(b/h)^2	6μU/Wb
193	Comp-2	846.009	9.525	0.00192	1619.219754	941.1714823	80647.66327	0.000617581
194	Comp-4	846.009	9.525	0.00192	1619.219754	915.02783	49282.51916	0.000617581
195	Comp-6	846.009	9.525	0.00192	1619.219754	935.2680769	86926.93197	0.000617581
196	Comp-10	846.009	9.525	0.00192	1619.219754	794.429692	49160.04764	0.000617581
197	Comp-12	846.009	9.525	0.00192	1619.219754	897.3176139	51946.77218	0.000617581
198	Comp-20	846.009	9.525	0.00192	1619.219754	797.8030665	46897.50008	0.000617581
199	Comp-22	846.009	9.525	0.00192	1619.219754	835.7535295	56480.01301	0.000617581
200	Comp-26	846.009	9.525	0.00192	1619.219754	814.669939	53393.015	0.000617581
201	Comp-30	846.009	9.525	0.00192	1619.219754	815.5132826	49052.00886	0.000617581
202	Comp-32	846.009	9.525	0.00192	1619.219754	897.3176139	73990.27806	0.000617581

	Y	Z	AA	AB	AC	AD	AE	AF
1								
2								
3	#251 Havoline SAE30 Motored 1000 rpm							
4	Stroke/Rev	∂/b	(∂+ho)/ho	ΔPBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
5	Comp-2	0.002951913	2.081206616	0.018708437	1.092298402	0.524839001	0.006252002	0.003472497
6	Comp-4	0.004328782	3.34453739	0.008555888	1.43066167	0.427760704	0.004153065	0.002306702
7	Comp-6	0.004588859	3.219123607	0.010732339	1.378284794	0.428155288	0.00416073	0.00231096
8	Comp-8	0.003591453	2.618184092	0.012363245	1.131589167	0.43220382	0.004239788	0.00235487
9	Comp-10	0.003291785	2.598515896	0.010643317	1.158399209	0.44579262	0.004510583	0.002505275
10	Comp-12	0.00419057	2.836942112	0.013061803	1.283963175	0.452587019	0.004649124	0.002582224
11	Comp-14	0.003478136	2.639608682	0.011294333	1.274666144	0.482899664	0.005292742	0.002939704
12								
13	#252 Havoline SAE30 Motored 1500 rpm							
14	Stroke/Rev	∂/b	(∂+ho)/ho	ΔPBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
15	Comp-2	0.001914556	2.073071646	0.007250144	1.704762534	0.822336525	0.003391809	0.001559783
16	Comp-6	0.002381171	2.0542976	0.011617759	1.56313712	0.760910746	0.00290402	0.001335465
17	Comp-8	0.002952746	2.48038512	0.009060882	2.195358229	0.885087647	0.003929206	0.001806914
18	Comp-10	0.002311864	1.816468395	0.018260534	1.963478103	1.080931608	0.005860419	0.002695016
19	Comp-12	0.001914509	1.826190403	0.012229881	1.950443745	1.068039643	0.005721461	0.002631114
20	Comp-14	0.002187454	2.157507983	0.008133877	1.694795084	0.785533633	0.003095008	0.001423294
21	Comp-16	0.001777856	1.771806018	0.01208494	1.718782684	0.970073849	0.004719998	0.002170574
22	Comp-18	0.001738661	1.917900627	0.008171588	1.899620704	0.990468785	0.004920552	0.002262802
23	Comp-20	0.002149248	1.741387492	0.019140366	2.009810315	1.154143075	0.006681154	0.003072446
24	Comp-22	0.002264947	1.981112066	0.012137985	1.9438718	0.981202343	0.004828913	0.00222066
25								
26	#253 Havoline SAE30 Motored 2000 rpm							
27	Stroke/Rev	∂/b	(∂+ho)/ho	ΔPBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
28	Comp-6	0.001033142	1.337135817	0.018958248	2.343897372	1.752923931	0.005134168	0.002218355
29	Comp-8	0.001517624	1.699596114	0.009499958	2.319134614	1.364521015	0.003111031	0.001344205
30	Comp-12	0.001407887	1.407501964	0.024097083	2.668792194	1.896119694	0.006007246	0.002595592
31	Comp-14	0.000612956	1.196202532	0.019703237	2.216918421	1.853296881	0.00573897	0.002479676
32	Comp-16	0.001195621	1.363811695	0.02180329	2.896497848	2.123825349	0.007536706	0.003256436
33	Comp-18	0.001378812	1.54041522	0.013141455	2.461753201	1.598110152	0.004267341	0.001843819
34	Comp-20	0.000678785	1.166824645	0.033422037	2.750341725	2.357116588	0.009283379	0.004011133
35	Comp-24	0.001041058	1.492554251	0.009018415	2.203885391	1.476586455	0.003643021	0.001574065
36	Comp-28	0.000878397	1.300340651	0.017267994	2.558569996	1.967615174	0.006468808	0.002795022
37								
38	#254 Havoline SAE30 Motored 2500 rpm							
39	Stroke/Rev	∂/b	(∂+ho)/ho	ΔPBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
40	Comp-2	0.002300858	2.087343808	0.008894597	4.800215794	2.29967664	0.003725627	0.001608022
41	Comp-4	0.001630072	1.644237112	0.012717525	4.963807786	3.018912387	0.006420471	0.002771147
42	Comp-6	0.00231594	1.925429868	0.012440796	5.20250984	2.701999136	0.005143234	0.002219877
43	Comp-8	0.001813565	1.792415552	0.010404974	4.258797429	2.376010086	0.003977062	0.001716545
44	Comp-10	0.001083938	1.548411507	0.007760258	3.725914298	2.406281717	0.004079048	0.001760563
45	Comp-12	0.001333178	1.440454596	0.018199283	4.089230774	2.838847393	0.005677406	0.002450432
46	Comp-16	0.001901432	1.814141927	0.010835324	4.471609272	2.464861875	0.004280071	0.001847327
47	Comp-18	0.001246761	1.508976385	0.011919324	3.912266915	2.592662784	0.004735414	0.002043857
48	Comp-20	0.000934263	1.414941474	0.010070364	3.552649041	2.310809887	0.00444113	0.001916841
49	Comp-22	0.00154028	1.537732235	0.016298514	4.568341928	2.970830567	0.006217583	0.002683578
50	Comp-26	0.001089508	1.416565346	0.013588619	3.778832751	2.667602141	0.005013118	0.002163718
51	Comp-30	0.002222013	1.714913137	0.01918966	4.999086755	2.915067036	0.005986361	0.00258378
52	Comp-32	0.001088037	1.436012675	0.012370007	3.945269821	2.747378132	0.005317441	0.002295067
53	Comp-34	0.001192599	1.379591837	0.019608106	4.038872891	2.92758538	0.006037887	0.002606019
54								
55	#301 MOBIL 1 Motored 1000 rpm							
56	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
57	Comp-2	0.003866263	2.264053254	0.019137066	1.278292729	0.564603649	0.008877259	0.004930622
58	Comp-4	0.005274434	2.347386172	0.031346626	1.420974864	0.605343458	0.010204583	0.005667846
59	Comp-6	0.004438909	2.563351935	0.016491578	1.300147456	0.50720599	0.007164078	0.003979084
60	Comp-8	0.004303603	2.404679708	0.019201404	1.163543811	0.483866441	0.006519924	0.003621307
61	Comp-10	0.003414302	2.180787191	0.017103461	1.213470959	0.556437127	0.008622312	0.004789019
62	Comp-12	0.00386736	2.241042879	0.019864554	1.268316579	0.565949269	0.008919624	0.004954152
63	Comp-14	0.003245494	2.083609071	0.018350156	1.197973127	0.574951004	0.009205624	0.005113003
64								
65	#302 Mobil 1 Motored 1500 rpm							
66	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
67	Comp-2	0.003171299	1.732888022	0.033735966	2.1072079	1.216009271	0.009375181	0.004311341
68	Comp-4	0.002738831	2.16516938	0.009955118	2.1115886	0.975253308	0.006030326	0.002773151
69	Comp-6	0.003074764	1.972204161	0.018021986	2.214626311	1.122919399	0.007994717	0.00367651
70	Comp-8	0.0020562	1.645484414	0.018283248	1.874026897	1.1388907	0.008223752	0.003781836
71	Comp-10	0.002453972	1.783188024	0.017688913	1.978616106	1.10959477	0.007806111	0.003589777
72	Comp-12	0.002259162	1.809598379	0.014029742	1.792892685	0.990768286	0.006223721	0.002862087
73	Comp-14	0.002346702	1.831257266	0.014359496	2.01256653	1.099008079	0.007657865	0.003521603

	Y	Z	AA	AB	AC	AD	AE	AF
74	Comp-16	0.002446234	1.80153793	0.01678193	1.902957769	1.056296255	0.007074201	0.003253195
75	Comp-18	0.001894864	1.455373798	0.031197103	1.851302016	1.272045723	0.010259149	0.004717849
76	Comp-20	0.002823889	2.006412605	0.014185252	1.998876843	0.996244161	0.006292707	0.002893811
77	Comp-22	0.002915444	2.014415331	0.014882362	2.168081375	1.076283198	0.007344446	0.003377472
78								
79	#303 Mobil 1 Motored 2000 rpm							
80	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
81	Comp-2	0.002501601	1.966834967	0.010436537	3.008497369	1.529613526	0.005063922	0.002187433
82	Comp-4	0.00193921	1.630080645	0.014766668	3.060892803	1.877755442	0.007631355	0.003296472
83	Comp-6	0.00217598	1.689441481	0.015528874	3.261388626	1.93045374	0.008065706	0.003484096
84	Comp-8	0.001714436	1.720556032	0.008825352	2.736525694	1.590489146	0.005475011	0.002365009
85	Comp-10	0.00214401	1.605769231	0.019528289	3.135851589	1.95286566	0.008254073	0.003565464
86	Comp-12	0.002002996	1.603011472	0.017200216	3.046961069	1.90077309	0.007819593	0.003377784
87	Comp-14	0.002545074	1.840836408	0.014282451	3.39949451	1.846711905	0.007381113	0.003188377
88	Comp-16	0.001688312	1.621382106	0.011508344	2.604325653	1.606238063	0.005583974	0.002412077
89	Comp-18	0.002378401	1.877423626	0.01145451	3.005923027	1.601089378	0.005548234	0.002396638
90	Comp-20	0.001934844	1.676945051	0.012735328	3.022429103	1.802342361	0.007030693	0.003037008
91	Comp-22	0.001812268	1.571143847	0.015695629	2.745611607	1.747524017	0.006609519	0.002855076
92	Comp-26	0.001946904	1.659714045	0.01357697	2.988356927	1.800525178	0.007016523	0.003030887
93	Comp-28	0.001882881	1.769826104	0.009325792	2.804972908	1.584886166	0.005436504	0.002348375
94								
95	#304 Mobil 1 Motored 2500 rpm							
96	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
97	Comp-1	0.000974309	1.325597937	0.01346306	3.381495654	2.550921029	0.006056574	0.002614085
98	Comp-3	0.001659826	1.636723655	0.010217312	3.843278815	2.348153767	0.005131993	0.002215026
99	Comp-5	0.001190476	1.382852662	0.014537558	3.59968593	2.603087103	0.00630682	0.002722094
100	Comp-7	0.001626462	1.434757973	0.021042921	4.020189849	2.801998612	0.0073075	0.003153999
101	Comp-11	0.001458523	1.480326026	0.013863334	3.583809298	2.420959461	0.005455167	0.002354511
102	Comp-13	0.000947744	1.289587393	0.016104081	3.452260068	2.677026843	0.006670194	0.00287893
103	Comp-17	0.000985184	1.365012616	0.010952989	3.31299933	2.427083305	0.0054828	0.002366438
104	Comp-19	0.001184183	1.429899719	0.01140819	3.686803273	2.57836492	0.006187594	0.002670635
105	Comp-21	0.001531099	1.534609159	0.012332389	3.655707757	2.382175119	0.005281781	0.002279676
108	Comp-23	0.000830931	1.301039281	0.011455039	3.350422818	2.575189594	0.006172363	0.002664061
107	Comp-25	0.000809397	1.232798347	0.018175086	3.519168728	2.854618304	0.007584538	0.003273571
108	Comp-27	0.001079011	1.344900662	0.014715582	3.454528158	2.568612132	0.006140872	0.002650469
109	Comp-29	0.000703888	1.189210139	0.020808079	3.479703959	2.926063145	0.007968937	0.003439482
110	Comp-31	0.001325118	1.468162639	0.012045616	3.47244607	2.365164443	0.005206618	0.002247234
111								
112	#352 Pennzoil 15W-40 Motored 1500 rpm							
113	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
114	Comp-2	0.002050587	1.767616053	0.012169974	1.762806781	0.997279232	0.0065624	0.003017834
115	Comp-4	0.001221403	1.368893738	0.018695503	1.504034307	1.098722469	0.007965355	0.003663008
116	Comp-6	0.001267184	1.297756997	0.030887106	1.766126741	1.360907123	0.012220419	0.005619773
117	Comp-8	0.00133661	1.379747872	0.021127126	1.554387041	1.126573248	0.00837429	0.003851064
118	Comp-10	0.0014440152	1.399890804	0.022118495	1.655184729	1.182367028	0.009224307	0.004241959
119	Comp-12	0.001928911	1.551749073	0.020843116	1.583160032	1.020242292	0.006868087	0.00315841
120	Comp-16	0.002085948	1.662539225	0.016904613	1.807810689	1.08737927	0.007801735	0.003587765
121	Comp-18	0.002312467	1.662539225	0.020775406	1.807810689	1.08737927	0.007801735	0.003587765
122	Comp-22	0.001303075	1.456639433	0.013887168	1.364688189	0.936874396	0.005791511	0.002663328
123								
124	#353 Pennzoil 15W40 Motored 2000 rpm							
125	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
126	Comp-6	0.001894534	1.527525711	0.019817065	2.81455419	1.842557654	0.007352731	0.003176117
127	Comp-8	0.001446997	1.440801976	0.01655655	2.41454513	1.675834133	0.00608231	0.00262734
128	Comp-10	0.002361526	1.886417792	0.010905117	2.647352951	1.403375733	0.004265348	0.001842477
129	Comp-12	0.002355953	1.792645503	0.013573663	2.725539435	1.520400676	0.005006366	0.002162571
130	Comp-14	0.001398517	1.415632855	0.017395531	2.780158506	1.963897981	0.008353036	0.003608213
131	Comp-16	0.001425252	1.426462882	0.017161004	2.600855082	1.823289701	0.007199758	0.003110037
132	Comp-18	0.000932527	1.305151326	0.014348742	2.327918965	1.783639122	0.00689002	0.002976242
133	Comp-20	0.001541849	1.457300979	0.017466306	2.725539435	1.870265288	0.007575529	0.003272357
134	Comp-22	0.001365412	1.575498273	0.008648904	2.128551392	1.351033783	0.00395311	0.001707602
135	Comp-24	0.001139025	1.365935919	0.014885991	2.321708633	1.699720024	0.00625693	0.00270277
136	Comp-26	0.001352774	1.386776722	0.018795395	2.648626865	1.909915867	0.007900144	0.003412579
137	Comp-28	0.000999097	1.330565084	0.014035341	2.347186917	1.764052691	0.00673953	0.002911236
138								
139	#354 Pennzoil 15W40 Motored 2500 rpm							
140	Stroke/rev	∂/b	(∂+ho)/ho	ΔPBh^2/6μUb^	rhoUhGamma/μ	rhoUh/μ	P1	P2
141	Comp-2	0.001189566	1.395962414	0.016453316	3.761695241	2.69469665	0.00557419	0.002405883
142	Comp-4	0.001113494	1.394945098	0.014490614	4.108872613	2.945544321	0.00666029	0.002874655
143	Comp-8	0.000720826	1.209129057	0.02165791	4.113971735	3.402425664	0.008886675	0.003835588
144	Comp-10	0.000619035	1.173046252	0.0233287	3.857558737	3.288496707	0.008301505	0.003583022
145	Comp-12	0.000751766	1.247603882	0.016804859	3.584245791	2.872903684	0.006335839	0.002734619
146	Comp-18	0.000677202	1.19819576	0.021282984	3.870088008	3.229929647	0.008008443	0.003456534

	Y	Z	AA	AB	AC	AD	AE	AF
147	Comp-20	0.000561675	1.17179803	0.019485796	3.881451766	3.312389736	0.008422574	0.003635277
148	Comp-26	0.000948859	1.316243929	0.016411307	3.553359679	2.699620945	0.005594581	0.002414684
149	Comp-32	0.000922134	1.375401048	0.010999709	3.909715472	2.84260033	0.006202883	0.002677234
150								
151	#401 Pennzoll SAE30 Motored 1000 rpm							
152	Stroke/Rev	∂/b	(∂+ho)/ho	ΔPBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
153	Comp-2	0.001616622	1.430344828	0.035239211	1.120264959	0.783213207	0.0139937	0.007772404
154	Comp-4	0.001642472	1.533893116	0.023633577	1.052506514	0.686166789	0.010740684	0.005965609
155	Comp-6	0.001795009	1.483868411	0.034365369	1.123445825	0.7571061	0.013076335	0.00726288
156	Comp-8	0.001966372	1.506300845	0.037666599	1.133468554	0.752484842	0.012917191	0.007174487
157	Comp-10	0.0019728	1.46729941	0.04450595	1.104120565	0.752484842	0.012917191	0.007174487
158	Comp-12	0.001875053	1.512928225	0.033369996	1.253681278	0.828645575	0.015664271	0.008700275
159	Comp-14	0.001829015	1.488871775	0.034953207	1.160295857	0.779312145	0.013854646	0.007695171
160								
161	#402 Pennzoll SAE30 Motored 1500 rpm							
162	Stroke/Rev	∂/b	(∂+ho)/ho	WBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
163	Comp-1	0.002733389	1.826112074	0.024488919	2.65644795	1.454701487	0.010806951	0.004969765
164	Comp-3	0.002884232	1.897495084	0.023101537	2.664611662	1.404278559	0.010070753	0.004631212
165	Comp-5	0.002847561	1.978538622	0.018942391	2.84445344	1.437653735	0.01055514	0.004853966
166	Comp-7	0.003440511	2.153950034	0.019884578	2.680819032	1.244605952	0.007910777	0.003637909
167	Comp-9	0.003023342	2.089040497	0.017239756	2.867383867	1.372584147	0.009621291	0.004424519
168	Comp-11	0.003056426	1.926597844	0.024338278	3.047105591	1.581599191	0.012774629	0.005874636
169	Comp-13	0.004137002	2.458425667	0.017998958	3.063312961	1.246046607	0.007929102	0.003646336
170	Comp-15	0.002683155	1.883584662	0.020627179	2.624273319	1.393233536	0.009912958	0.004558647
171	Comp-17	0.003217831	2.311394778	0.01346803	2.634718069	1.139882332	0.006635528	0.003051463
172	Comp-19	0.002360767	1.980846492	0.01295832	2.545277398	1.284944295	0.008431872	0.003877544
173	Comp-21	0.00342248	1.928212928	0.030411027	3.044104226	1.57871788	0.012728126	0.005853252
174								
175	#403 Pennzoll SAE30 Motored 2000 rpm							
176	Stroke/Rev	∂/b	(∂+ho)/ho	WBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
177	Comp-1	0.002770125	1.867746735	0.019995279	4.563146642	2.443129229	0.010264244	0.004433786
178	Comp-3	0.003157915	2.096731027	0.016267289	4.429863017	2.112747396	0.007675899	0.003315713
179	Comp-5	0.002258322	1.642068084	0.024273037	4.412697702	2.687280597	0.012418242	0.005364236
180	Comp-7	0.002851311	1.912116838	0.019173559	4.547596885	2.378304921	0.009726781	0.004201621
181	Comp-9	0.002686456	1.80828457	0.021674324	4.74287759	2.622860178	0.01182999	0.005110132
182	Comp-11	0.00224912	1.626577315	0.025280788	4.607574516	2.832680914	0.013798421	0.005960424
183	Comp-13	0.002010593	1.59958554	0.022062808	4.208733367	2.631139918	0.011904796	0.005142446
184	Comp-15	0.0021298	1.642343449	0.021570377	3.781619933	2.302575589	0.009117208	0.003938307
185	Comp-17	0.002012157	1.541379583	0.027104059	3.930453314	2.549958074	0.011181502	0.004830009
186	Comp-19	0.003022799	1.81286417	0.027132958	4.837993631	2.668701667	0.012247125	0.005290319
187	Comp-21	0.002514439	1.71238309	0.024443854	4.621710658	2.6989934	0.01252673	0.005411099
188	Comp-23	0.001624394	1.399114033	0.03250151	3.954484755	2.826420623	0.013737499	0.005934108
189	Comp-25	0.003271725	1.936301484	0.023957237	4.68996803	2.422126961	0.01008853	0.004357884
190								
191	#404 Pennzoll SAE30 Motored 2500 rpm							
192	Stroke/Rev	∂/b	(∂+ho)/ho	WBh^2/6Uμb^2	rhoUhGamma/μ	rhoUh/μ	P1	P2
193	Comp-2	0.001508691	1.428446075	0.020077702	4.634486281	3.244425086	0.009097375	0.003926529
194	Comp-4	0.00063476	1.14091463	0.032855864	4.603688053	4.035085475	0.014071684	0.006073496
195	Comp-6	0.000966162	1.284857071	0.018627366	3.990052772	3.105444848	0.008334666	0.003597335
196	Comp-10	0.001056247	1.234191692	0.032937717	4.329092088	3.507633471	0.010633323	0.004589461
197	Comp-12	0.001007024	1.229519205	0.031170748	4.738786162	3.854178237	0.012838201	0.005541111
198	Comp-20	0.000728028	1.157660567	0.034526782	4.175100949	3.606498371	0.011241184	0.004851821
199	Comp-22	0.001081204	1.256953842	0.028668898	4.327280428	3.442672503	0.010243114	0.004421042
200	Comp-26	0.001188367	1.274595081	0.030326434	4.399229229	3.451471997	0.010295544	0.004443672
201	Comp-30	0.000949516	1.210295807	0.033010264	4.362737211	3.60468671	0.011229893	0.004846947
202	Comp-32	0.001222688	1.33258535	0.021884223	4.303470033	3.229414185	0.009013388	0.003890279

	AG	AH	AI	AJ	AK
1					
2					
3	**#251 Havoline SAE30 Motored 1000 rpm**				
4	Stroke/Rev	Delta2(Volts)	Delta2(μm)	Gamma2	1/OLY#
5	Comp-2	0.063472	1.782921348	1.653690086	53.451819
6	Comp-4	0.100092	2.811573034	2.264777983	116.8785768
7	Comp-6	0.073239	2.057275281	1.924606431	93.17633677
8	Comp-8	0.10986	3.085955056	2.373936968	80.88491543
9	Comp-10	0.097656	2.743146067	2.184082256	93.95567343
10	Comp-12	0.083009	2.331713483	1.991377148	76.55910648
11	Comp-14	0.117191	3.291882022	2.311756344	88.5399754
12					
13	**#252 Havoline SAE30 Motored 1500 rpm**				
14	Stroke/Rev	Delta2(Volts)	Delta2(μm)	Gamma2	1/OLY#
15	Comp-2	0.065923	1.851769663	1.878071846	137.9282955
16	Comp-6	0.051271	1.440196629	1.738041429	86.07511807
17	Comp-8	0.031734	0.891404494	1.392718362	110.3645362
18	Comp-10	0.036624	1.028764045	1.37111647	54.76291128
19	Comp-12	0.017091	0.48008427	1.175276128	81.76694742
20	Comp-14	0.043943	1.234353933	1.612727805	122.9426069
21	Comp-16	0.043945	1.234410112	1.49618924	82.74761665
22	Comp-18	0.029293	0.822837079	1.323940858	122.3752372
23	Comp-20	0.02685	0.754213483	1.254816361	52.24560478
24	Comp-22	0.019529	0.548567416	1.218003818	82.38600051
25					
26	**#253 Havoline SAE30 Motored 2000 rpm**				
27	Stroke/Rev	Delta2(Volts)	Delta2(μm)	Gamma2	1/OLY#
28	Comp-6	0.017091	0.48008427	1.181531402	52.74748974
29	Comp-8	0.019532	0.548651685	1.266510206	105.2636227
30	Comp-12	0.03906	1.097191011	1.383542812	41.49879824
31	Comp-14	-0.002442	-0.068595506	0.975467149	50.75308266
32	Comp-16	0.009766	0.274325843	1.085614097	45.86463865
33	Comp-18	0.017086	0.47994382	1.199058648	76.09507359
34	Comp-20	0.00403	0.113202247	1.031832543	29.92037841
35	Comp-24	0.024413	0.685758427	1.307829069	110.8842354
36	Comp-28	0.00732	0.205617978	1.069265708	57.91060515
37					
38	**#254 Havoline SAE30 Motored 2500 rpm**				
39	Stroke/Rev	Delta2(Volts)	Delta2(μm)	Gamma2	1/OLY#
40	Comp-2	0.01709	0.48005618	1.211431399	112.4278088
41	Comp-4	0.01221	0.342977528	1.115069268	78.63165412
42	Comp-6	0.021969	0.617106742	1.231323246	80.38071174
43	Comp-8	0.024417	0.685870787	1.292373642	96.10788517
44	Comp-10	0.031743	0.891657303	1.375314802	128.8616958
45	Comp-12	0.043949	1.234522472	1.440454596	54.94722056
46	Comp-16	0.036354	1.021179775	1.419617711	92.29073667
47	Comp-18	0.019532	0.548651685	1.214335879	83.89737313
48	Comp-20	0.021969	0.617106742	1.248937689	99.30127561
49	Comp-22	0.04883	1.371629213	1.467630722	61.35528749
50	Comp-26	0.024418	0.685898876	1.260425332	73.59099517
51	Comp-30	0.03418	0.96011236	1.333593598	52.11139872
52	Comp-32	0.046384	1.302921348	1.480334693	80.84069966
53	Comp-34	0.03418	0.96011236	1.332167153	50.9993176
54					
55	**#301 MOBIL 1 MOTORED 1000 RPM**				
56	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	1/OLY#
57	Comp-2	0.08057	2.383727811	1.662146614	52.254614
58	Comp-4	0.03417	1.010946746	1.261919362	31.90136028
59	Comp-6	0.04882	1.444378698	1.446619705	60.63701024
60	Comp-8	0.06347	1.877810651	1.608649789	52.07952523
61	Comp-10	0.04394	1.3	1.366410941	58.46769949
62	Comp-12	0.04883	1.444674556	1.400344347	50.34092502
63	Comp-14	0.05859	1.733431953	1.472843193	54.49544986
64					
65	**#302 Mobil 1 Motored 1500 rpm**				
66	Stroke/rev	Delta2(Volts)	Delta2(μm)	Gamma2	1/OLY#
67	Comp-2	0.03906	1.155621302	1.293155209	29.64195564
68	Comp-4	0.0708	2.094674556	1.66254913	100.4508408
69	Comp-6	0.07079	2.094378698	1.575341352	55.48777999
70	Comp-8	0.0537	1.588757396	1.430322943	54.69487696
71	Comp-10	0.08789	2.600295858	1.722898503	56.5325851
72	Comp-12	0.05615	1.661242604	1.517225497	71.27714982
73	Comp-14	0.04883	1.444674556	1.405497426	69.64032853

	AG	AH	AI	AJ	AK
74	Comp-16	0.07079	2.094378698	1.611629514	59.58790339
75	Comp-18	0.04394	1.3	1.315253264	32.05425856
76	Comp-20	0.0708	2.094674556	1.648589227	70.49575083
77	Comp-22	0.03662	1.083431953	1.310523192	67.19363309
78					
79	#303 Mobil 1 Motored 2000 rpm				
80	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
81	Comp-2	0.04395	1.300295858	1.435105435	95.81722099
82	Comp-4	0.04395	1.300295858	1.354435484	67.72008351
83	Comp-6	0.04883	1.444674556	1.383040477	64.39617108
84	Comp-8	0.05371	1.589053254	1.511377702	113.309929
85	Comp-10	0.02685	0.794378698	1.208204094	51.20776454
86	Comp-12	0.03174	0.939053254	1.252868069	58.1388036
87	Comp-14	0.07568	2.239053254	1.620582206	70.01599194
88	Comp-16	0.08789	2.600295858	1.828603752	86.89347692
89	Comp-18	0.05127	1.516863905	1.484914405	87.30186022
90	Comp-20	0.03906	1.155621302	1.328180138	78.5217316
91	Comp-22	0.04394	1.3	1.380762565	63.71200457
92	Comp-26	0.05403	1.59852071	1.454415475	73.65413713
93	Comp-28	0.04883	1.444674556	1.46655838	107.2295035
94					
95	#304 Mobil 1 Motored 2500 rpm				
96	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
97	Comp-1	0.04639	1.372485207	1.412465546	74.27731946
98	Comp-3	0.04638	1.372189349	1.447986091	97.87309981
99	Comp-5	0.02441	0.722189349	1.212686242	68.7873457
100	Comp-7	0.03418	1.011242604	1.276671523	47.52191921
101	Comp-11	0.04639	1.372485207	1.434607457	72.13272181
102	Comp-13	0.01953	0.577810651	1.165466407	62.09606254
103	Comp-17	0.03418	1.011242604	1.319409401	91.29927615
104	Comp-19	0.0293	0.866863905	1.257741027	87.65632044
105	Comp-21	0.03174	0.939053254	1.302199372	81.08728952
106	Comp-23	0.02441	0.722189349	1.214990312	87.29782327
107	Comp-25	0.02686	0.794674556	1.213411727	55.02037234
108	Comp-27	0.03906	1.155621302	1.344900662	67.95517864
109	Comp-29	0.03662	1.083431953	1.283853965	48.05825631
110	Comp-31	0.04882	1.444378698	1.468162639	83.01775581
111					
112	#352 PENNZOIL 15W-40 MOTORED 1500 RPM				
113	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
114	Comp-2	0.03418	1.071473354	1.316071759	82.1694452
115	Comp-4	0.03174	0.994984326	1.266409266	53.48879926
116	Comp-6	0.06348	1.989968652	1.430168733	32.37596893
117	Comp-8	0.03907	1.22476489	1.319826457	47.33251526
118	Comp-10	0.03662	1.147962382	1.285625146	45.21103297
119	Comp-12	0.06836	2.142946708	1.617915574	47.97747198
120	Comp-16	0.01953	0.612225705	1.165634806	59.15544913
121	Comp-18	0.01221	0.382758621	1.103553558	48.13383695
122	Comp-22	0.05371	1.68369906	1.528693769	72.00892202
123					
124	#353 PENNZOIL 15W40 MOTORED 2000 RPM				
125	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
126	Comp-6	0.01709	0.535736677	1.147696828	50.46155938
127	Comp-8	0.04395	1.377742947	1.417616876	60.39905607
128	Comp-10	0.03174	0.994984326	1.360149779	91.70007255
129	Comp-12	0.026851	0.841724138	1.281224144	73.67207876
130	Comp-14	0.06591	2.066144201	1.534419849	57.48602787
131	Comp-16	0.01953	0.612225705	1.170567686	58.27164738
132	Comp-18	0.03906	1.224451411	1.348718864	69.6925202
133	Comp-20	0.00244	0.076489028	1.020774798	57.25309136
134	Comp-22	0.031737	0.994890282	1.374067395	115.6215797
135	Comp-24	0.00977	0.306269592	1.091530823	67.17725261
136	Comp-26	0.02197	0.688714734	1.183174921	53.20452206
137	Comp-28	0.0415	1.300940439	1.374616357	71.24871605
138					
139	#354 Pennzoil 15W40 Motored 2500 prm				
140	Stroke/rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
141	Comp-2	0.017089	0.535705329	1.184783902	60.77802268
142	Comp-4	0.01953	0.612225705	1.193194183	69.01018694
143	Comp-8	0.02686	0.84200627	1.230024835	46.17250612
144	Comp-10	0.01953	0.612225705	1.173046252	42.86565515
145	Comp-12	0.043943	1.377523511	1.445682932	59.50659887
146	Comp-18	0.04151	1.301253918	1.374470005	46.98589301

	AG	AH	AI	AJ	AK
147	Comp-20	0.03174	0.994984326	1.279204785	51.31943194
148	Comp-26	0.03662	1.147962382	1.395250944	60.93360063
149	Comp-32	0.034183	1.071567398	1.350390028	90.91149588
150					
151	**#401 Pennzoil SAE30 Motored 1000 rpm**				
152	Stroke/Rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
153	Comp-2	0.06338	1.986833856	1.485670498	28.37748013
154	Comp-4	0.09033	2.831661442	1.790081343	42.31268023
155	Comp-6	0.04883	1.530721003	1.387078874	29.09906213
156	Comp-8	0.04883	1.530721003	1.389456054	26.54871994
157	Comp-10	0.0415	1.300940439	1.330993779	22.46890578
158	Comp-12	0.04885	1.531347962	1.35380604	29.96703998
159	Comp-14	0.05615	1.760188088	1.432422025	28.60967833
160					
161	**#402 Pennzoil SAE30 Motored 1500 rpm**				
162	Stroke/Rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
163	Comp-1	0.04151	1.301253918	1.342576545	40.83479479
164	Comp-3	0.0415	1.300940439	1.354791827	43.28716326
165	Comp-5	0.03906	1.224451411	1.326179541	52.79164482
166	Comp-7	0.05127	1.607210031	1.494550014	50.29022931
167	Comp-9	0.02442	0.765517241	1.213592233	58.00546259
168	Comp-11	0.02197	0.688714734	1.166767876	41.08754158
169	Comp-13	0.0708	2.219435737	1.682146642	55.55877083
170	Comp-15	0.06103	1.913166144	1.525894011	48.47972678
171	Comp-17	0.068363	2.143040752	1.720012217	74.24990881
172	Comp-19	0.04395	1.377742947	1.410632533	77.17049993
173	Comp-21	0.02441	0.765203762	1.185627376	32.88280965
174					
175	**#403 Pennzoil SAE30 Motored 2000 rpm**				
176	Stroke/Rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
177	Comp-1	0.05615	1.760188088	1.464126302	50.01180544
178	Comp-3	0.03906	1.224451411	1.373351176	61.47305956
179	Comp-5	0.03906	1.224451411	1.293529721	41.19797563
180	Comp-7	0.03417	1.071159875	1.290141802	52.15515701
181	Comp-9	0.03173	0.994670846	1.244302433	46.13753945
182	Comp-11	0.02685	0.84169279	1.191416554	39.55572924
183	Comp-13	0.03906	1.224451411	1.29979277	45.32514692
184	Comp-15	0.02929	0.918181818	1.256884757	46.35987544
185	Comp-17	0.03418	1.071473354	1.270689792	36.89484301
186	Comp-19	0.04638	1.453918495	1.350964813	36.85554679
187	Comp-21	0.02685	0.84169279	1.200897868	40.91007953
188	Comp-23	0.07295	2.286833856	1.521220349	30.76780158
189	Comp-25	0.03174	0.994984326	1.264632316	41.74104002
190					
191	**#404 Pennzoil SAE30 Motored 2500 rpm**				
192	Stroke/Rev	Delta2(Volts)	Delta2(µm)	Gamma2	1/OLY#
193	Comp-2	0.01709	0.535736677	1.136327377	49.80649664
194	Comp-4	0.02685	0.84169279	1.172214739	30.43596709
195	Comp-6	0.03662	1.147962382	1.305192099	53.68445619
196	Comp-10	0.04151	1.301253918	1.306279053	30.36033096
197	Comp-12	0.02686	0.84200627	1.180365297	32.0813602
198	Comp-20	0.0293	0.918495298	1.21026193	28.96302367
199	Comp-22	0.02929	0.918181818	1.220192452	34.88100541
200	Comp-24	0.04882	1.530407524	1.366076785	32.97453286
201	Comp-30	0.02197	0.688714734	1.157739805	30.29360822
202	Comp-32	0.05615	1.760188088	1.449991986	45.69501938

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Olechowski
Analysis of single and multi-grade lubricant film thickness in a diesel engine.